



Repair Manual

Jetta 2011 ➤

Jetta 2015 ➤

Engine Mechanical, Fuel Injection and Ignition

Engine ID	CBT A	CBU A	CCC A						
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Edition 01.2015





List of Workshop Manual Repair Groups

Repair Group

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- 28 - Ignition/Glow Plug System



Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



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00 – General, Technical Data

1 Safety Precautions

(Edition 01.2015)


⇒ [“1.1 Safety Precautions, Working on Fuel Supply System”, page 1](#)

⇒ [“1.2 Safety Precautions During Road Test with Testing Equipment”, page 2](#)

⇒ [“1.3 Cooling System Safety Precautions”, page 2](#)

⇒ [“1.4 Ignition System Safety Precautions”, page 3](#)

1.1 Safety Precautions, Working on Fuel Supply System

**WARNING**

Fuel lines are under pressure.

Fuel poses a risk of danger of injury to eyes and skin.

Wear protective eyewear and protective clothing in order to avoid injury and contact with the skin. Place a cloth on the connection location before loosening hose connections. Open the connection carefully and release the pressure.

For safety reasons, switch off the current to the fuel pump before opening the fuel system. Otherwise, the fuel pump will activate when the driver door opens or when the ignition switches on. It is possible to interrupt the current flow by using one of the following possibilities:

- ◆ *Disconnect the battery.*
- or
- ◆ *Remove the Transfer Fuel Pump - G6- fuse.*
- or
- ◆ *Disconnect the connector on the fuel delivery unit flange.*

Always observe the following when removing and installing the fuel level sensor or the fuel pump (fuel delivery unit) from full or partially filled fuel tanks.

- ◆ Before starting work, switch the exhaust extraction system on and place an extraction hose close to the fuel tank installation opening to extract fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m³/h can be used.
- ◆ Do not let fuel come in contact with skin. Wear fuel-resistant gloves.



Caution

Note the following whenever working inside the engine compartment due to limited space:

- ◆ *Route all lines and cables in their original locations.*
- ◆ *Make sure that there is sufficient clearance to all moving or hot components.*

1.2 Safety Precautions During Road Test with Testing Equipment

If special testing equipment is required during road test, pay attention to the following:

- ◆ Test equipment must always be secured to the rear seat and operated from there by a second person.

If the vehicle is involved in a collision while testing and measuring equipment is operated from the front passenger seat, the person sitting in that seat could be seriously injured when the airbag deploys.

1.3 Cooling System Safety Precautions



WARNING

The coolant system is under pressure when the engine is warm.

Risk of scalding due to hot steam and hot coolant.

Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.



Caution

Note the following whenever working inside the engine compartment due to limited space:

- ◆ *Route all lines and cables in their original locations.*
- ◆ *Make sure that there is sufficient clearance to all moving or hot components.*



Note

- ◆ *When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.*
- ◆ *Secure all hose connections with hose clamps, allocation. Refer to the Parts Catalog.*
- ◆ *The Spring Clip Pliers - VAS6499- are recommended for installing spring clamps.*
- ◆ *Replace the gaskets and seals.*
- ◆ *Arrows on coolant pipes and coolant hoses must line up across from each other.*



1.4 Ignition System Safety Precautions

To reduce the risk of personal injury and/or damage to the fuel injection and ignition system, always observe the following:

- ◆ Do not touch or remove ignition wires when engine is running or turning at starter speed.
- ◆ Only disconnect and reconnect wires for injection and ignition system, including test leads, if ignition is turned off.



Caution

Note the following whenever working inside the engine compartment due to limited space:

- ◆ ***Route all lines and cables in their original locations.***
- ◆ ***Make sure that there is sufficient clearance to all moving or hot components.***



2 Identification

⇒ **"2.1 Engine Number/Engine Characteristics", page 4**

2.1 Engine Number/Engine Characteristics

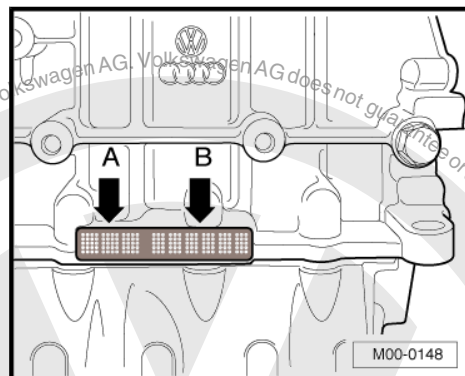
Engine Number

Engine code -arrow A- and engine number -arrow B- ("serial number") are located on rear side of engine, above partition of cylinder block/upper section of oil pan.

The engine code is also stamped in on the right side on cylinder head and on cylinder block.

A label with the "engine code" and "serial number" is also affixed to the toothed belt guard.

The first three digits describe the mechanical structure of the engine and are still stamped on the engine. The fourth position describes the engine output and torque. This depends on the engine control module. Four-digit engine codes are found on the type label and vehicle data label. It can also be read via the engine control module.



Note

Vehicle data label locations. Refer to ⇒ Maintenance ; Booklet ; Vehicle Data Label .

Engine Data

Engine Codes	CBTA	CBUA	CCCA
Manufactured	From 07/2007	From 07/2007	From 07/2007
Emission values in accordance with	TIER 2/BIN5 (US coalition)	SULEV. Refer to ¹⁾ .	Refer to ³⁾ . / EU2 DDK
Displacement cm ³	2480	2480	2480
Output kW at RPM	125/5700	125/5700	125/5700
Torque Nm at RPM	240/4250	240/4250	240/4250
Engine idle speed ⁴⁾ RPM	680	680	680
Engine speed limitation RPM	approximately 6300	approximately 6300	approximately 6300
Hole diameter in mm	82.5	82.5	82.5
Stroke mm	92.8	92.8	92.8
Compression ratio	9.5	9.5	9.5
Valves per cylinder	4	4	4
RON minimum	95 unleaded. Refer to ²⁾ .	95 unleaded. Refer to ²⁾ .	95 unleaded. Refer to ²⁾ .
Fuel injection, ignition	Motronic ME 17.5	Motronic ME 17.5	Motronic ME 17.5
Knock control	2 sensors	2 sensors	2 sensors
Camshaft adjustment	yes	yes	yes
Intake manifold change-over	no	no	no
Oxygen sensor regulation	2 sensors	3 sensors	2 sensors
Catalytic Converter	yes	yes	yes
Exhaust Gas Recirculation (EGR)	no	no	no
Turbocharger, G-Charger	no	no	no
Secondary Air Injection System	no	yes	no

1) SULEV: Super Ultra Low Emission Vehicles



- 2) Also 91 RON, but with reduced performance.
- 3) according to resolution No. 15, dated 12/13/1995 from Conama
- 4) If the voltage supply for the engine control module drops below 12 Volts, the idle speed gradually increases up to 780 rpm. Idle speed is not adjustable.
- 5) Engine Control Module, Replacing. Refer to
⇒ ["5 Engine Control Module", page 193](#)





3 General Information

⇒ ["3.1 Cylinder Numbering", page 6](#)

3.1 Cylinder Numbering

- Remove the air filter housing (engine cover). Refer to
⇒ ["3.2 Air Filter Housing, Removing and Installing",
page 186](#) .



Note

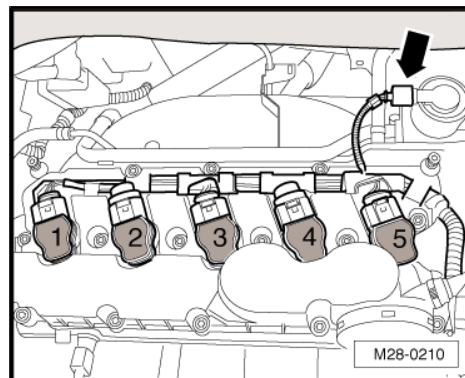
Ignore -arrow-.



Note

Cylinder 1 is located opposite the force producing side.

Ignition sequence	1 - 2 - 4 - 5 - 3
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4 Repair Information

⇒ [“4.1 Guidelines for Clean Working Conditions”, page 7](#)

⇒ [“4.2 Engine Contaminants”, page 7](#)

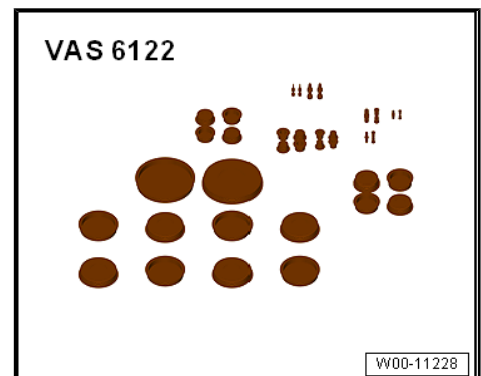
4.1 Guidelines for Clean Working Conditions

When working on the fuel supply/injection system, pay careful attention to the following “5 rules” of cleanliness:

- ◆ Thoroughly clean the connecting points and the surrounding area before loosening.
- ◆ Place the removed parts on a clean surface and cover them. Only use lint-free cloths!
- ◆ Carefully cover or seal opened components if the repair will not be done immediately.
- ◆ Install only clean parts: remove the replacement parts from their packaging just before installing them. Do not use parts that have been stored loose (for example, in tool boxes etc.).
- ◆ When the fuel system is open: avoid working with compressed air if possible. If possible do not move vehicle.

4.2 Engine Contaminants

- ◆ Close off any open intake or exhaust channels with plugs whenever working on the engine to prevent contaminants from getting in. Use the plugs from Engine Bung Set - VAS6122- .





10 – Engine Assembly

1 Engine, Removing and Installing

⇒ [“1.1 Engine, Removing”, page 8](#)

⇒ [“1.2 Engine and Transmission, Separating”, page 14](#)

⇒ [“1.3 Engine, Securing on Engine and Transmission Holder”, page 18](#)

⇒ [“1.4 Engine, Installing”, page 20](#)

1.1 Engine, Removing

Special tools and workshop equipment required

- ◆ Hose Clip Pliers - VAS6362-
- ◆ Hose Clip Pliers - VAS6362-
- ◆ Engine and Gearbox Jack - VAS6931-
- ◆ Tensioning Strap - T10038-
- ◆ Step Ladder
- ◆ Engine Holder Bracket - T03000-
- ◆ Cable Tie
- ◆ Foam Mat
- ◆ Guide Pins - T10093-
- ◆ Adapters For Service Position - T10467-

Procedure



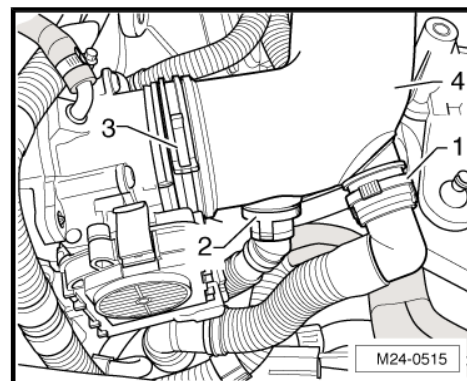
Note

- ◆ *The engine is removed downward together with the transmission.*
- ◆ *All cable ties which are opened or cut open when removing engine, must be replaced in the same position when installing engine.*
- ◆ *Seal off the disconnected fuel and ventilation lines to prevent dirt from getting into the system.*
- ◆ *Leave the key in the ignition lock. This prevents the steering lock from engaging.*
- ◆ *If engine oil must be drained because of work performed on the removed engine, it should be performed with the engine installed. If engine hangs on the Engine And Transmission Holder - Engine Lateral Bracket - T03001-, the engine is not in installation position and less engine oil flows out.*
- Check the DTC memories on all control modules. Refer to Vehicle Diagnostic Tester .
- Remove the air filter housing (engine cover). Refer to [“3.2 Air Filter Housing, Removing and Installing”, page 186](#) .

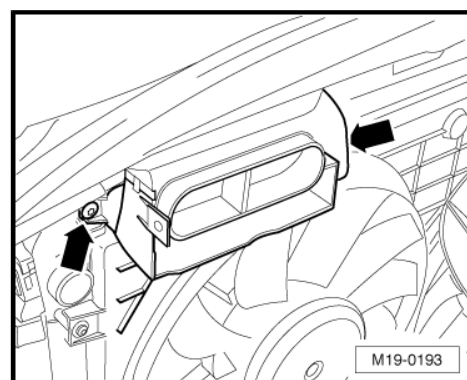


- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.

Continuation for All Vehicles



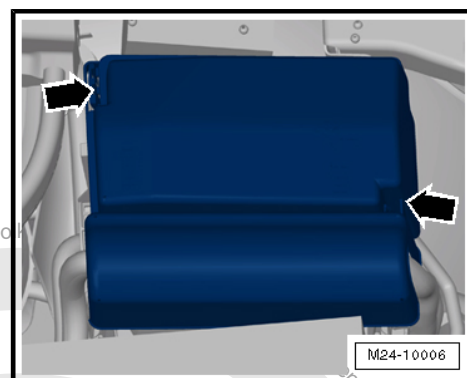
- Remove the intake air scoop from the lock carrier -arrows-.



- Remove the E-box cover inside the engine compartment -arrows-.

Vehicles with an Automatic Transmission

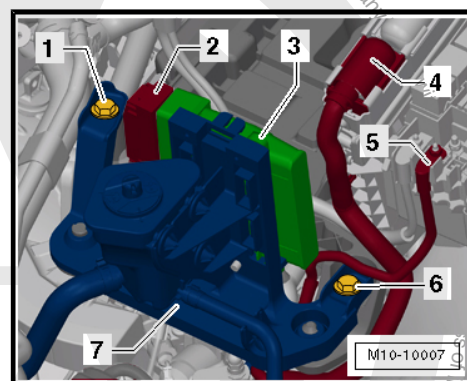
- Unclip the transmission control module -3- from the bracket -7- and remove it upward.



- Disconnect the connector -2- from the transmission control module.

Continuation for All Vehicles

- Remove the bolts -1- and -6-.
- Move the bracket -7- with the power steering fluid reservoir to the side.
 The hoses remain connected.
- Remove the wire -5- and free it up.
- Disconnect the connector -4- from the engine control module and free up the electric engine wiring harness. Refer to ["5 Engine Control Module", page 193](#).
- Remove the battery tray. Refer to [Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing](#).





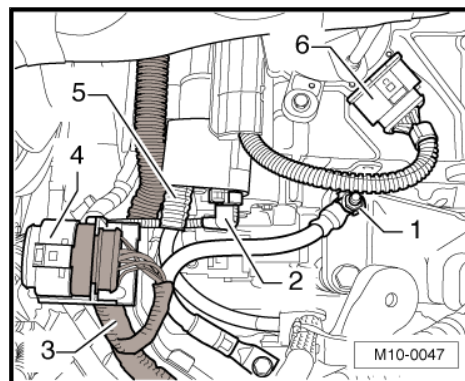
- Disconnect the connector -4-, open the locking mechanism and lay the engine wiring harness -3- on the engine.
- Disconnect the ground cable -1- and the starter connections -2- and -5-.

Vehicles with an Automatic Transmission

- Disconnect the connector -6- from the multifunction switch.
- Remove the selector lever cable from the transmission. Refer to ➔ Rep. Gr. 37 ; Selector Mechanism; Selector Mechanism Assembly Overview .

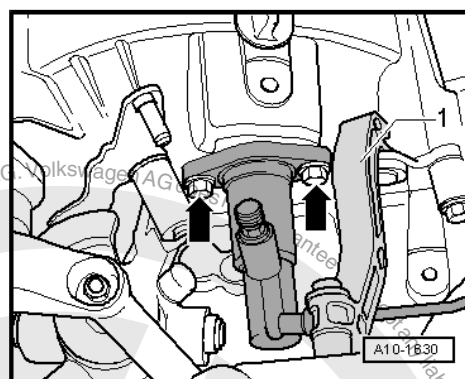
Vehicles with Manual Transmission

- Remove the gearshift mechanism from the transmission. Refer to ➔ Rep. Gr. 34 ; Overview - Gearshift Mechanism .
- Remove the brace -1-.
- Remove the clutch slave cylinder -arrows- and move it to the side. Do not open the line system.



Caution

Do not operate the clutch pedal anymore after slave cylinder has been removed. Slave cylinder may be damaged by doing this.



- Disconnect connector for back-up light switch from transmission.

Continuation for All Vehicles

- Disconnect vacuum hose from brake booster.
- Disconnect the connector from the Heated Oxygen Sensor - G39- on the bulkhead. Move the electrical wiring harness to the side.
- Open the cap on the reservoir and then close it again to release the pressure in the coolant system.
- Drain the coolant. Refer to ➔ ["1.4 Coolant, Draining and Filling", page 147](#) .



Note

The vehicle has a manual hood support that is attached to the lock carrier.

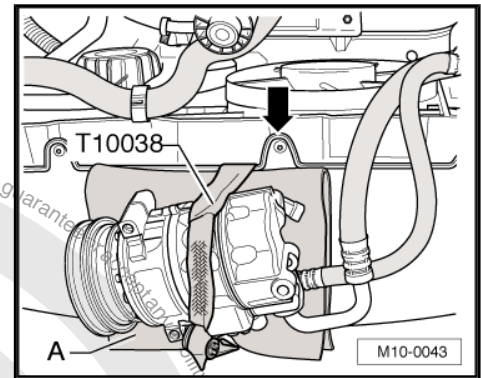
- Perform a service position. Refer to ➔ Body Exterior; Rep. Gr. 50 ; Lock Carrier; Service Position, Performing and Resetting .
- Remove the fan shroud. Refer to ➔ ["3.3 Fan Shroud, Removing and Installing", page 169](#) .

So that it is possible to remove the engine without opening the refrigerant circuit:

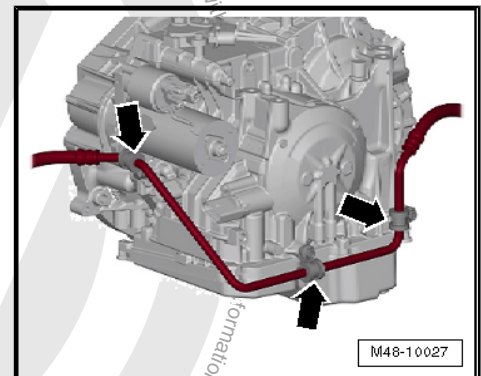
- Remove the ribbed belt. Refer to ➔ ["1.2 Ribbed Belt, Removing and Installing", page 45](#) .
- Remove the A/C compressor from the auxiliary components bracket. Refer to ➔ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing .



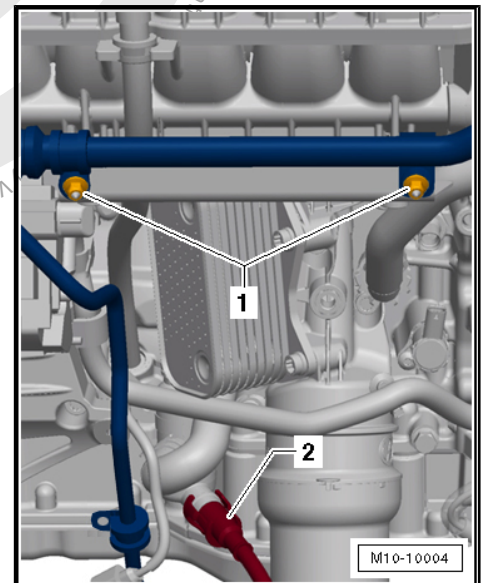
- Secure the A/C compressor to the bumper cover using a Tensioning Strap - T10038- and a suitable mat -A-. Slide Tensioning Strap - T10038- as far as possible on to mounting bolt -arrow-.



- Remove the clamps for the power steering pressure line on the transmission. Refer to ➤ Suspension, Wheels, Steering; Rep. Gr. 48; Hydraulic Power Steering; Hydraulic Pipes and Reservoir Assembly Overview .



- Remove the nuts -1- and the power steering pump line.
- If the vehicle has an engine preheater, remove the cable -2-.
- Remove the power steering pump from the auxiliary components bracket and move it forward. Refer to ➤ Suspension, Wheels, Steering; Rep. Gr. 48; Hydraulic Power Steering; Power Steering Pump, Removing and Installing .
- The power steering lines remain connected to the power steering pump.



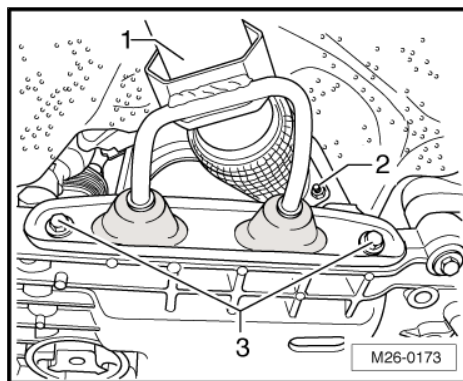
Caution

Danger of causing damage to the decoupling element:

- ◆ ***Do not bend the decoupling element more than 10°.***
- ◆ ***Do not stretch the decoupling element.***
- ◆ ***Do not damage the wire mesh on the decoupling element.***



- Remove the four nuts -2- and the bolts -3-.
- Remove the front exhaust pipe -1- from the exhaust manifold and tie it to the side. Refer to [⇒ “2.2 Catalytic Converter, Removing and Installing”, page 207](#).
- Remove the right drive axle. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Drive Axle; Drive Axle, Removing and Installing .
- Remove the left drive axle from the transmission. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Drive Axle; Drive Axle, Removing and Installing .



WARNING

Fuel lines are under pressure.

Fuel poses a risk of danger of injury to eyes and skin.

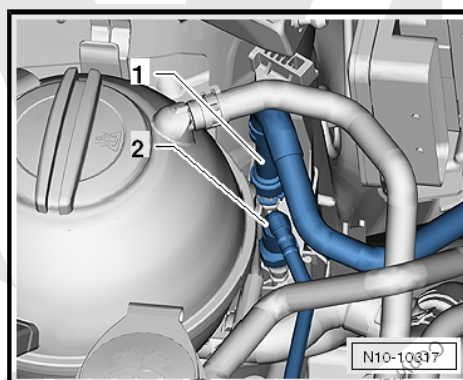
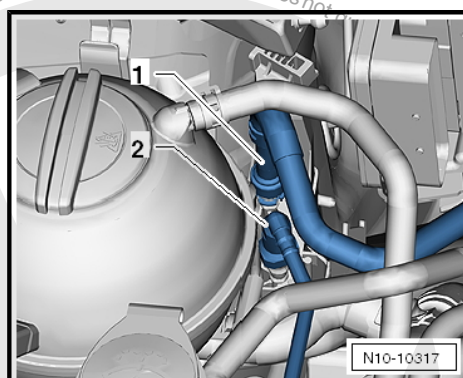
Wear protective eyewear and protective clothing in order to avoid injury and contact with the skin. Place a cloth on the connection location before loosening hose connections. Open the connection carefully and release the pressure.

Vehicles with Engine Codes CBTA and CBUA

- Disconnect the fuel supply line -1- and -2-. Refer to ⇒ Rep. Gr. 20 ; Couplings, Disconnecting Couplings .
- Seal the lines so that the fuel system is not contaminated by dirt etc.

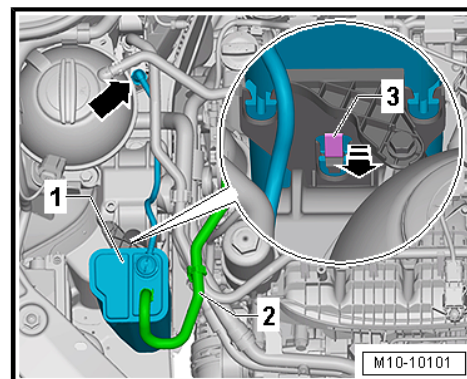
Vehicles with the Engine Code CCCA

- Remove the fuel supply line -1-. Refer to ⇒ Rep. Gr. 20 ; Couplings, Separating .
- Remove the vent line -arrow-. Refer to ⇒ Rep. Gr. 20 ; Couplings; Couplings, Disconnecting .
- Release the tab -3- in the direction of the arrow and remove the EVAP canister -1- upward.

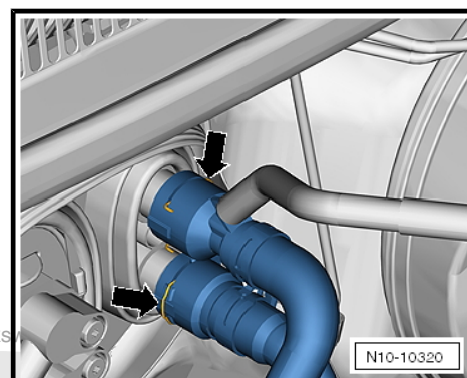


- Lay the EVAP canister -1- on the engine with the line attached -2-.

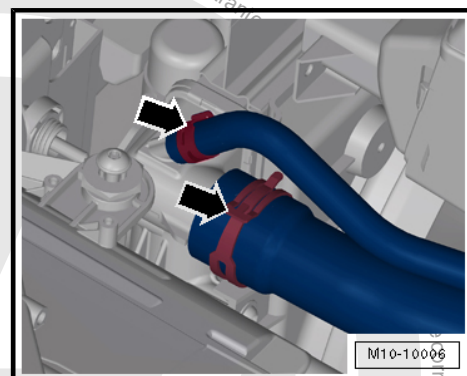
Continuation for All Vehicles



- Remove the coolant hoses from the heat exchanger -arrows-.



- Open the spring clamps -arrows- and remove the coolant hoses from the radiator.

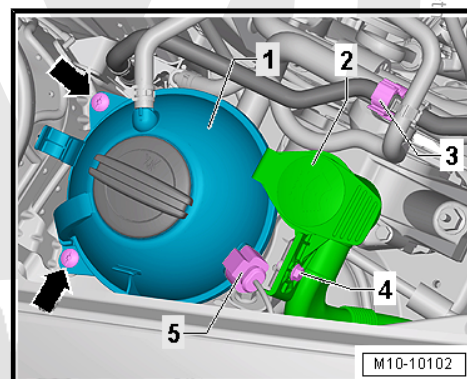


- Remove the bolt -4- and rotate the windshield washer fluid reservoir filler tube -2- forward.
- Open the clip -3- and remove the connector -5- from the coolant expansion tank -1-.
- Remove the bolts -arrows- and place the coolant expansion tank -1- on top of the engine with the hoses connected.



Note

Loosen the bolts on the engine mount and transmission mount one turn.



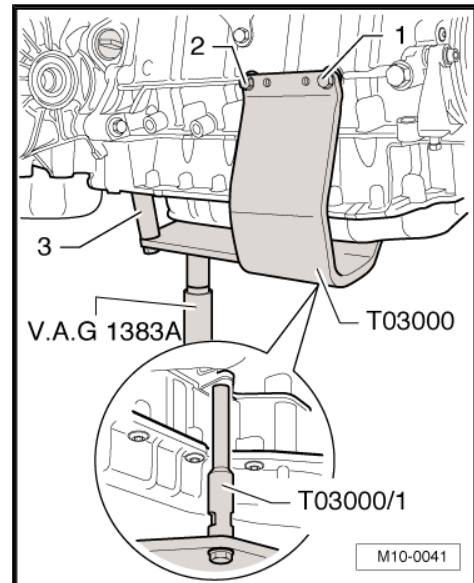


- Install the Engine Holder Bracket - T03000- as follows:
 - ◆ Remove the Engine Holder Bracket - Pins - T03000/1- from the Engine Holder Bracket - T03000- .
 - ◆ Attach the Engine Holder Bracket - T03000- to cylinder block with pin -3- and tighten bolts -1- and -2- hand-tight.
 - ◆ Then install in the engine holder bracket Engine Holder Bracket - Pins - T03000/1- and tighten to 20 Nm.
 - ◆ Then tighten bolts -1- and -2- to 25 Nm.
- Install the Engine and Gearbox Jack - VAS6931- on the Engine Holder Bracket - T03000- and slightly lift the engine/ transmission assembly.



WARNING

Use a commercially available Step Ladder when removing the bolts on the engine/transmission mount.

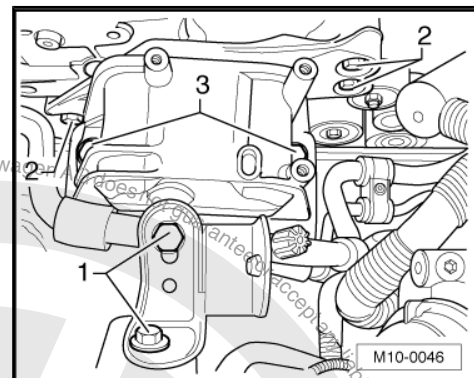


- Remove engine mount from above. To do this, remove the bolts -1-, -2- and -3-.



Note

The rear bolt -2- is accessible through a hole in the wheel housing.

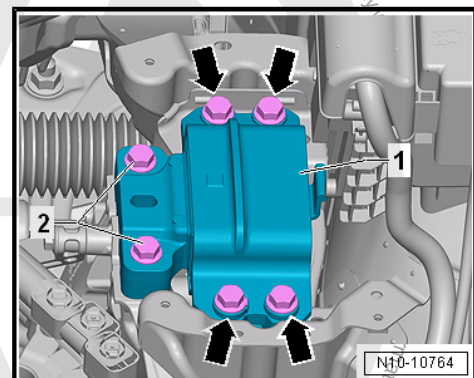


- Remove the bolts -2- from the transmission mount -1-.



Note

- ◆ Check that all hoses and lines between engine/transmission assembly and body have been disconnected.
 - ◆ A second technician is needed to lower the engine/transmission subassembly.
 - ◆ The engine/transmission assembly must be guided with care to prevent damage while lowering.
- Carefully lower the engine/transmission assembly. When doing this, rotate or push the engine/transmission assembly.



1.2 Engine and Transmission, Separating

⇒ **"1.2.1 Vehicles with automatic transmission", page 14**

⇒ **"1.2.2 Vehicles with Manual Transmission", page 17**

1.2.1 Vehicles with automatic transmission

Special tools and workshop equipment required

- ◆ Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12-
- ◆ Shop Crane - VAS6100-



- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Crankshaft Adapter - T03003-
- ◆ Socket - Sw15 - V/175-
- ◆ Hose Clamps - Up To 25mm - 3094- and Hose Clamps - Up To 40mm - 3093-

Conditions

- Engine with the transmission is removed and secured to the Engine Support - T10359A- .

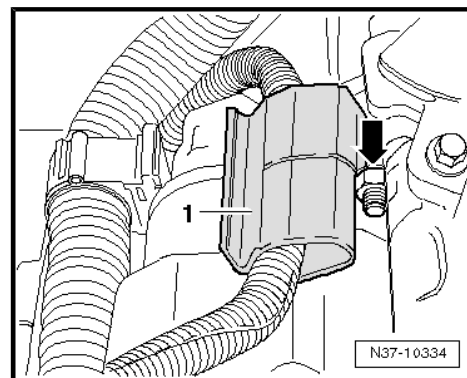
Disconnecting

- Remove the bracket -1- from the upper starter bolt -arrow-.
- Remove the bolt from the top of the starter.

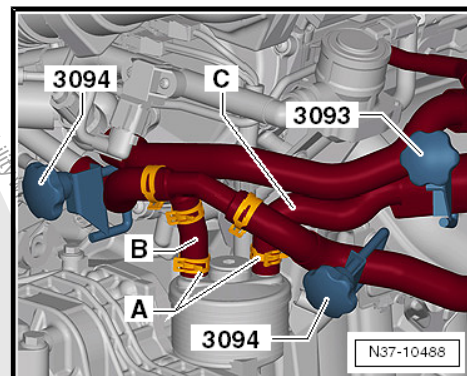


Note

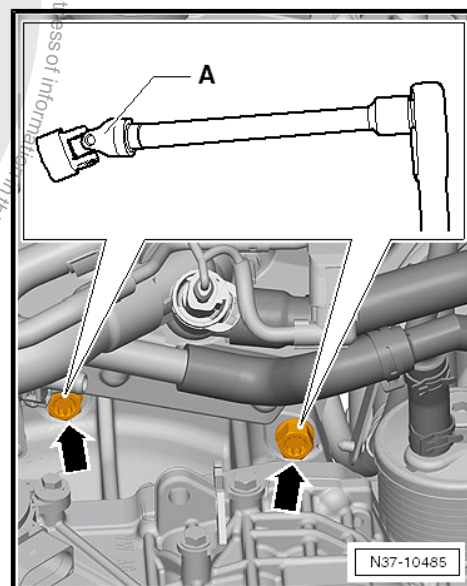
Mark the coolant hoses on the ATF cooler to prevent mixing them up when installing them again later.



- Clamp off the coolant hoses to the ATF cooler using Hose Clamps - Up To 25mm - 3094- and Hose Clamps - Up To 40mm - 3093- .
- Open the spring clamps -A- and pull the coolant hoses -B- and -C- off the ATF cooler.
- Seal the coolant hoses and connections with plugs taken from Engine Bung Set - VAS6122- .

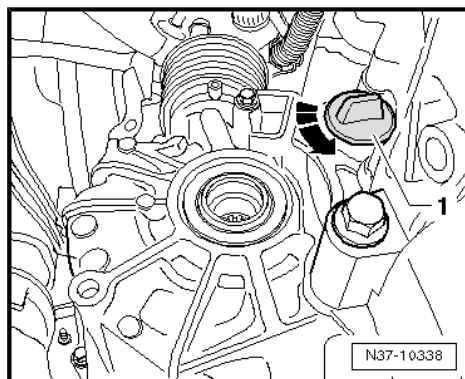


- Remove the upper transmission/engine bolts -arrows- using a 12-point socket -A-.

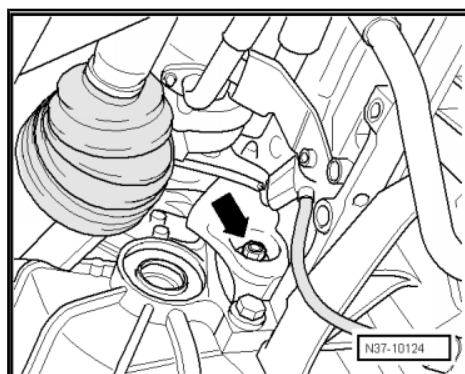




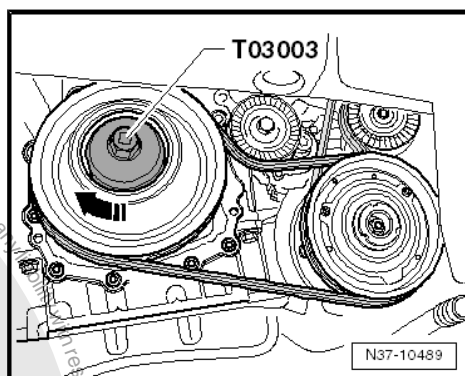
- Turn the cap -1- in direction of -arrow- and remove it.



- Remove the six -converter nuts- using the Socket - Sw15 - V/ 175- .

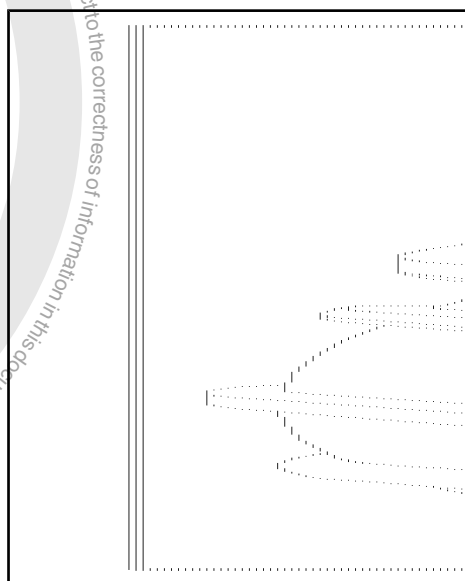


- Turn the engine in the direction of engine rotation in direction of -arrow- 60° additional turn using the Crankshaft Adapter - T03003- .



Note

- ♦ The torque converter will be pulled out when the transmission is separated from the engine if all 6 nuts are not removed!
- ♦ Counterhold the belt pulley/vibration damper using the Crankshaft Adapter - T03003- when loosening the nuts on the torque converter.
- Remove the selector lever cable bracket from the transmission.





- Secure the transmission with Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12- on the Shop Crane - VAS6100- but do not lift.
- Remove the last transmission/engine bolt.
- While pressing the torque converter off the drive plate, separate the transmission from the engine.



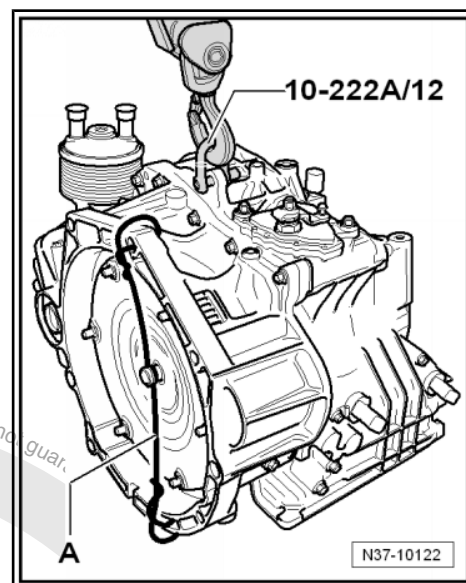
Note

Secure the torque converter from falling out.

Assembling

Assemble in reverse order of removal. Pay attention to the tightening specifications:

- ◆ Vehicles with an automatic transmission. Refer to ⇒ Rep. Gr. 37 ; Transmission, Removing and Installing; Transmission Tightening Specifications .



1.2.2 Vehicles with Manual Transmission

Special tools and workshop equipment required

- ◆ Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12-
- ◆ Shop Crane - VAS6100-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-

Conditions

- Engine with the transmission is removed and secured to the Engine/Gearbox Jack - Engine Support - T10359A- .

Disconnecting

- Remove the starter. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Starter, Removing and Installing .
- Disconnect all the electrical connections from the transmission to the engine and free them up.
- Secure the transmission with Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12- on the Shop Crane - VAS6100- but do not lift.
- Remove the upper engine/transmission connecting bolt.
- Support the transmission with the Shop Crane before removing the last connecting bolts.
- Remove the lower engine/transmission connecting bolts.

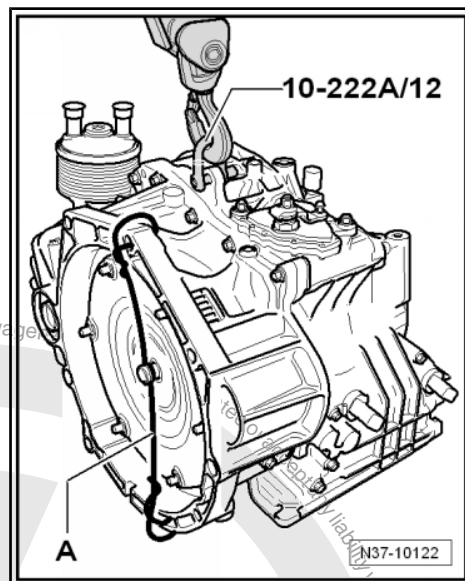


- Separate the transmission from the engine; when doing this, guide the transmission.

Assembling

Assemble in reverse order of removal. Pay attention to the tightening specifications:

- ◆ Vehicles with a manual transmission. Refer to ⇒ Rep. Gr. 34 ; Transmission, Removing and Installing; Transmission Tightening Specifications .



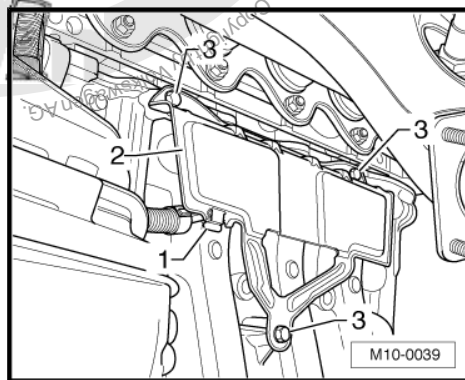
1.3 Engine, Securing on Engine and Transmission Holder

Special tools and workshop equipment required

- ◆ Lifting Tackle - 3033-
- ◆ Shop Crane - VAS6100-
- ◆ Engine and Gearbox Bracket VAS6095A - VAS6095A-
- ◆ Engine And Transmission Holder - Engine Lateral Bracket - T03001-
- ◆ Transport Arm - T03002-

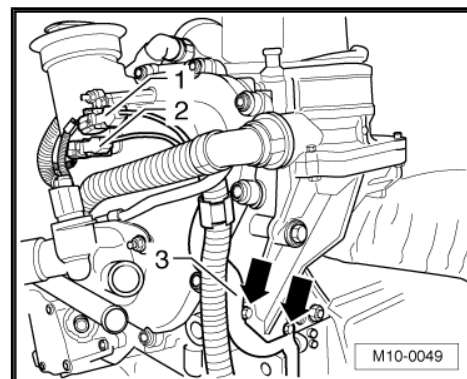
For performing work, secure engine using Engine And Transmission Holder - Engine Lateral Bracket - T03001- to Engine and Gearbox Bracket VAS6095A - VAS6095A- .

- Pull off clamp -1- for electric wiring harness, remove the screws -3- and then remove the cover plate -2-.



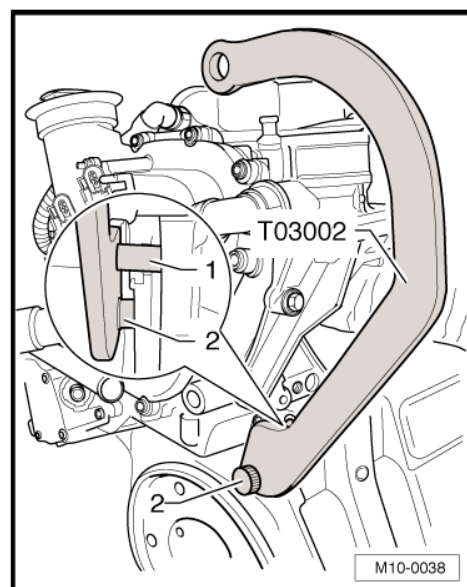


- Disconnect the connectors -1- and -2- and remove the bracket -3- -arrows- if equipped.



- Install the Transport Arm - T03002- , as illustrated.

Pin -1- engages in cylinder block. Tighten knurled bolt -2- hand-tight.



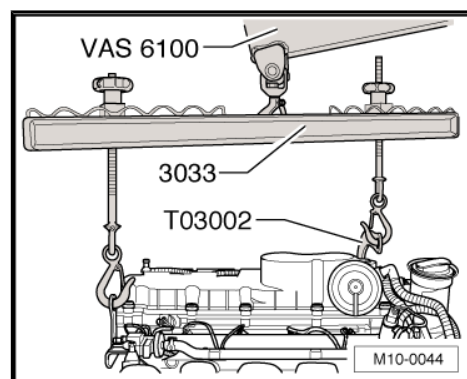
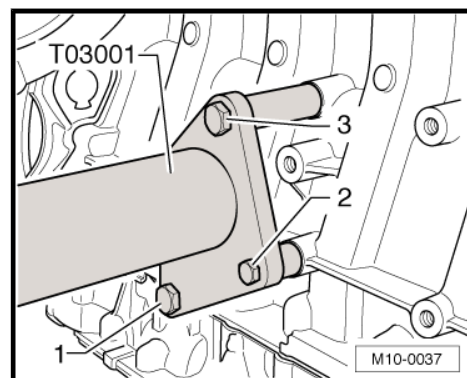
- Install the Engine And Transmission Holder - Engine Lateral Bracket - T03001- .

Tighten bolts -1- and -3- to 40 Nm, bolt -2- to 25 Nm.



Note

- ◆ Bolts are designed so that they cannot be lost.
- ◆ When removing, the Engine And Transmission Holder - Engine Lateral Bracket - T03001- must be held tense in direction of removal, otherwise the bolt -1- cannot be removed.
- Engage the Lifting Tackle - 3033- as shown and lift out of the engine using Shop Crane - VAS6100- from Engine/Gearbox Jack - VAG1383A-.
- Secure the engine to the Engine and Gearbox Bracket - VAS6095A- .





1.4 Engine, Installing

Vehicles with Manual Transmission

- Lightly coat the drive axle splines with Lubricating Grease - G 000 100- .
- Install the clutch and the clutch mechanism.

Continuation for All Vehicles

- Secure the engine mounts on the engine, shake the engine/ transmission assembly to align it and tighten the subframe mount.
- Install the front exhaust pipe. Refer to [⇒ "2.2 Catalytic Converter, Removing and Installing", page 207](#) .
- Install the right drive axle and attach the left drive axle to the transmission. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 40 ; Drive Axle, Removing and Installing .
- Install the power steering pump. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 48 ; Hydraulic Power Steering; Power Steering Pump, Removing and Installing .
- Install the A/C compressor. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing .
- Install the ribbed belt. Refer to [⇒ "1.2 Ribbed Belt, Removing and Installing", page 45](#) .
- Install the fan shroud. Refer to [⇒ "3.3 Fan Shroud, Removing and Installing", page 169](#) .
- Reset the service position. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Lock Carrier; Service Position, Performing and Resetting .
- Install the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Overview - Noise Insulation .

Vehicles with Manual Transmission

- Install the gearshift mechanism and adjust it. Refer to ⇒ Rep. Gr. 34 ; Overview - Gearshift Mechanism .
- Install the hydraulic clutch slave cylinder. Refer to ⇒ Rep. Gr. 30 ; Clutch Mechanism; Clutch Slave Cylinder, Removing and Installing .

Vehicles with an Automatic Transmission

- Install the selector lever cable and adjust it. Refer to ⇒ Rep. Gr. 37 ; Selector Mechanism; Overview - Selector Mechanism .

Continuation for All Vehicles

- Install the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery Tray, Removing and Installing .
- Bleed the fuel system. Refer to [⇒ "1.2 Fuel System, Filling/Bleeding", page 176](#) .
- Fill the coolant. Refer to [⇒ "1.4 Coolant, Draining and Filling", page 147](#) .
- Adapt the engine control module see Vehicle Diagnostic Tester "Guided Fault Finding" function.
- Perform a vehicle system test see Vehicle Diagnostic Tester "Guided Fault Finding" function.



- End the “Guided Fault Finding”.

Follow all safety precautions when performing the road test. Refer to

⇒ [“1.2 Safety Precautions During Road Test with Testing Equipment”, page 2](#) .

- Perform a road test. Refer to
 ⇒ [“1.2 Safety Precautions During Road Test with Testing Equipment”, page 2](#) .
- Perform another vehicle system test and correct any faults.

Tightening Specifications

Bolted Connections		Tightening Specifications
Bolts and Nuts	M6	10 Nm
	M7	15 Nm
	M8	25 Nm
	M10	40 Nm
	M12	60 Nm

- ◆ Refer to ⇒ [“2.1 Overview - Subframe Mount”, page 22](#)





2 Subframe Mount

⇒ "2.1 Overview - Subframe Mount", page 22

⇒ "2.2 Engine Mount, Removing and Installing", page 22

⇒ "2.3 Engine, Supporting in Installed Position", page 27

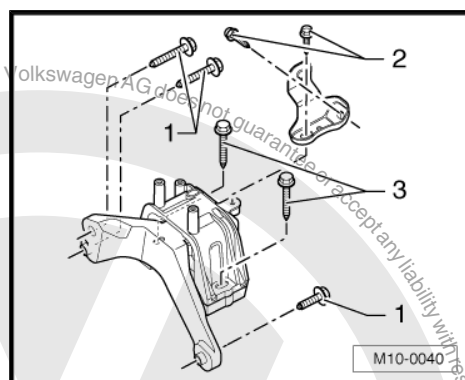
⇒ "2.4 Subframe Mount, Adjusting", page 32

⇒ "2.5 Subframe Mount, Checking Adjustment", page 35

2.1 Overview - Subframe Mount

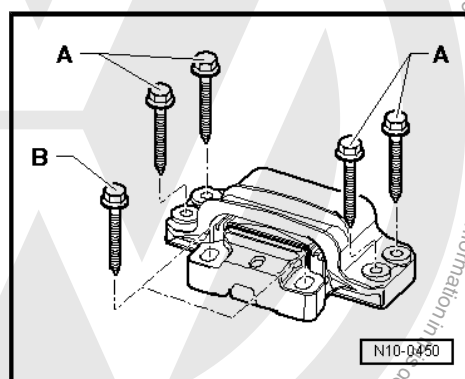
Engine Mount

- 1 - = 40 Nm +90°, replace the bolts after removing
- 2 - = 20 Nm +90°, replace the bolts after removing
- 3 - = 60 Nm +90°, replace the bolts after removing



Transmission Mount

- A - = 40 Nm +90°, replace the bolts after removing
- B - = 60 Nm +90°, replace the bolts after removing



Pendulum Support



Note

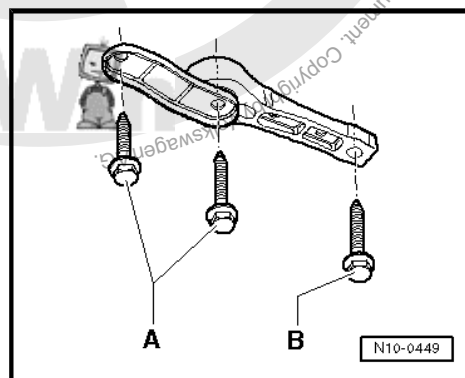
Attach the pendulum support to the transmission first and then to the subframe.

A - Strength category 10.9 = 50 Nm +90°, replace the bolts after removing

B - = 100 Nm +90°, replace the bolt after removing

Removing: remove the bolt -B- first and then the bolts -A-.

Installing: first tighten the bolt -A- and then bolt -B-.



2.2 Engine Mount, Removing and Installing

Special tools and workshop equipment required

- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support - Automatic Transmission Hook - 10-222A/7-
- ◆ Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-



- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2- from Engine Support - Basic Set - T40091-
- ◆ Engine Support - Supplement Kit Mount 5- T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Union Nut Socket - T40055-

Tool Development

- If the adapter for Engine Support Bridge - Engine Support 4 - 10-222A/4- does not have the indicated holes -arrow- shown they must be added.
- Dimension -a- = 225 mm.
- Hole diameter = 12.5 mm

Procedure



Note

Without removing the battery and battery tray

Removing

- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .

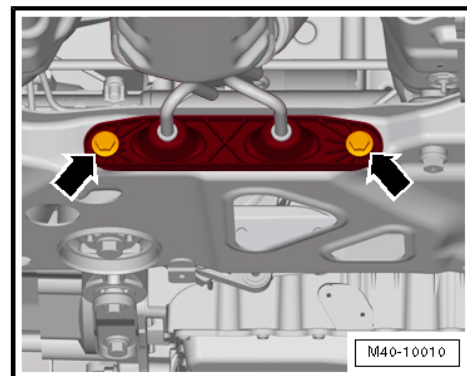
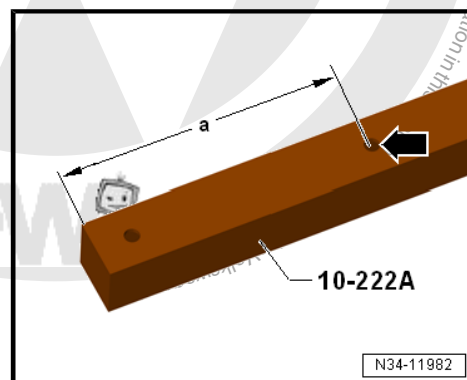


Caution

Danger of causing damage to the decoupling element:

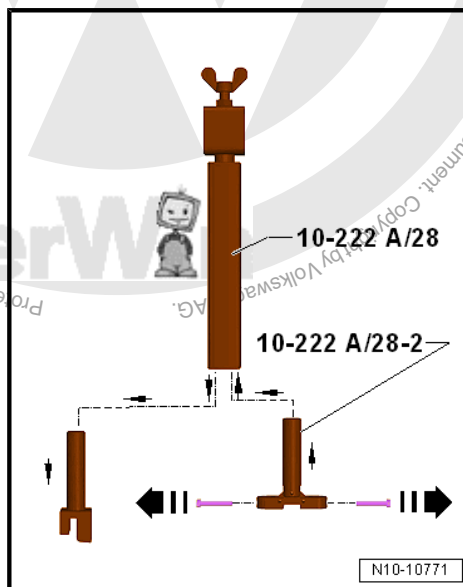
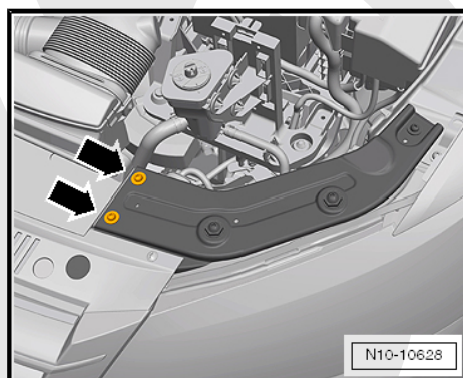
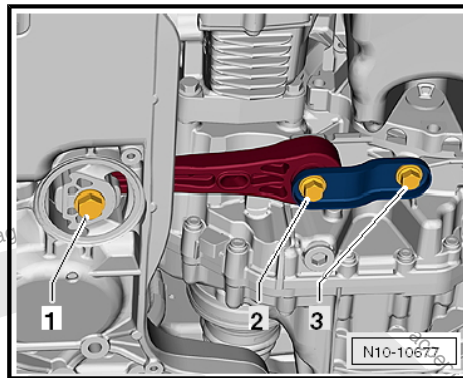
- ◆ ***Do not bend the decoupling element more than 10°.***
- ◆ ***Do not stretch the decoupling element.***
- ◆ ***Do not damage the wire mesh on the decoupling element.***

- Remove the exhaust system bracket from the subframe -arrows-.





- Remove the bolt -1-.
- Remove the bolts -2- and -3-.
- Remove the pendulum support.
- Remove the air filter housing (engine cover). Refer to ⇒ ["3.2 Air Filter Housing, Removing and Installing", page 186](#) .
- Remove the plenum chamber cover. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Bulkhead; Plenum Chamber Cover, Removing and Installing .
- Remove the bolts -arrows- from the left and right sides of the lock carrier bracket.
- Remove the lower mounts on the Engine Support Bridge - Engine Support 28 - 10-222A/28- and replace with the Engine Support 28-2 -10-222A/28-2 .
- Remove the bolts in direction of -arrows- for securing the engine support bridge on the lock carrier from the Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- .



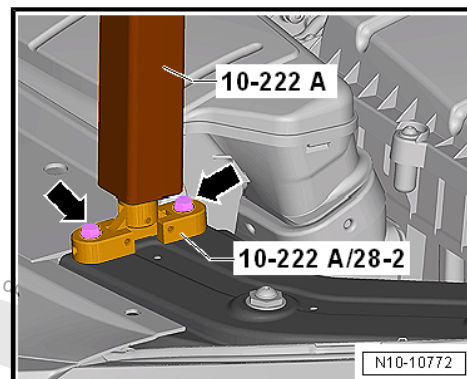


- Use the bolts from the Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- for attaching the Engine Support Bridge - Engine Support 28 - 10-222A/28- . Do not use the bolts for the bracket.
- Tighten the fastening bolts -arrows- to 8 Nm.



Caution

A second technician is needed when positioning the Engine Support Bridge - 10-222A- on the vehicle to keep the Engine Support Bridge from tipping.



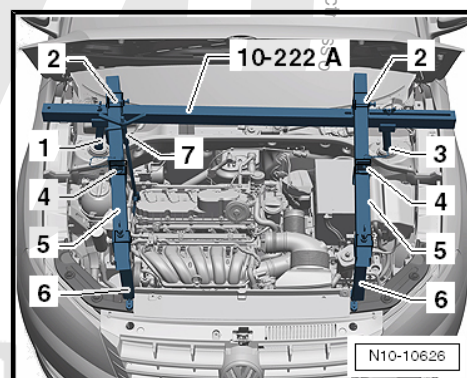
- Install the Engine Support Bridge - Engine Support 31-2 - 10-222A/31-2- on the inner hole from the Engine Support Bridge - 10-222A- and slide two Engine Support - Basic Set - Moveable Joint - T40091/3- from the left side.



Note

The Engine Support - Basic Set - Moveable Joint - T40091/3- bolts point in the direction of travel.

- Install the bolts on the left side of the Engine Support Bridge - Engine Support 31-1 - 10-222A/31-1- but do not tighten them.
- 1 - Engine Support Bridge - Engine Support 31 Adapter 31-2 - 10-222A/31-2-
 - 2 - Engine Support - Basic Set - Moveable Joint - T40091/3-
 - 3 - Engine Support Bridge - Engine Support 31 Adapter 31-1 - 10-222A/31-1-
 - 4 - Movable Joint - T40093/4-
 - 5 - Engine Support - Basic Set - Square Pipe - T40091/1-
 - 6 - Engine Support Bridge - Engine Support 28 - 10-222A/28- with Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2-
 - 7 - Push the Engine Support - Bracket w/Spindle and Hook - 10-222A/10- two times onto the right square pipe.
- Install the engine support bridge and attach the Engine Support Bridge - Engine Support 31 Adapter 31-1 - 10-222A/31-1- in the correct position.
 - Slide the Engine Support - Basic Set - Square Pipe - T40091/1- on the left and right sides through the Engine Support Bridge - Engine Support 28 - 10-222A/28- from the front and position the Engine Support - Basic Set - Moveable Joints - T40093/4- for the rail with holes on both sides.
 - Slide both Engine Support - Bracket w/Spindle and Hook - 10-222A/10- in front of and behind the Engine Support Brackets - T40093/4- on the right side.





- Push the Engine Support - Basic Set - Square Pipe - T40091/1- through the Engine Support - Basic Set - Movable Joint - T40091/3- .

- 1 - Rail with Holes - T40091/2-
- 2 - Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- 3 - Engine Support Bridge - Spindle - 10-222A/11-
- 4 - Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12-

- Push the Engine Support - Basic Set - Rail with Holes - T40091/2- from the right through the Engine Support - Supplement Kit - Moveable Joint - T40093/4- .

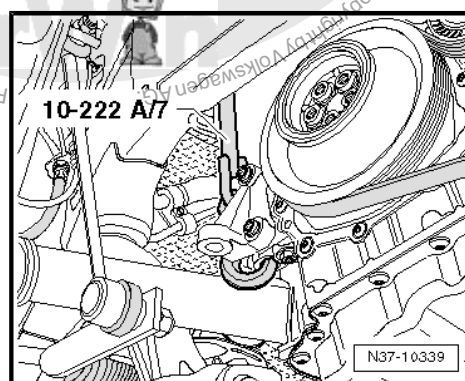
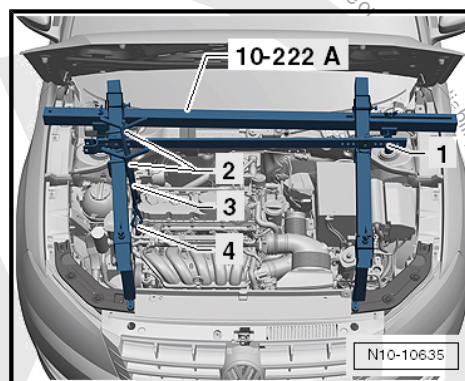
- Slide the Engine Support - Basic Set - Rail with Holes - T40091/2- into the moveable joint on the other side and secure it with a splint.

- Tighten all threaded connections on the engine support bridge hand-tight.

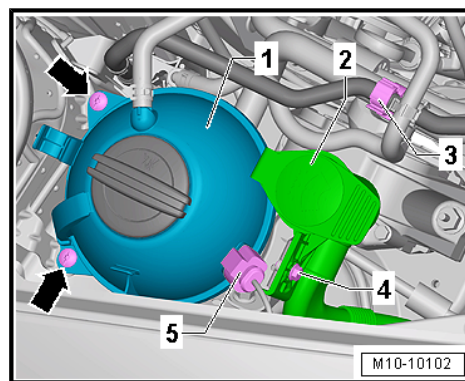
- Extend the right Engine Support - Bracket w/Spindle and Hook - 10-222A/10- with the right Engine Support - Automatic Transmission Hook - 10-222A/7- .

- Engage the Engine Support - Automatic Transmission Hook - 10-222A/7- on the cylinder block -image-.

- Position the spindles and support the engine.

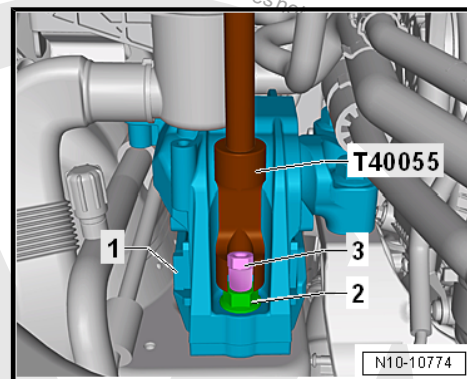


- Remove the bolt -4- and rotate the windshield washer fluid reservoir filler tube -2- forward.
- If applicable, open the clip -3- and remove connector -5- from the coolant reservoir -1-.
- Remove the bolts -arrows- and place the coolant expansion tank -1- on top of the engine with the coolant lines connected.





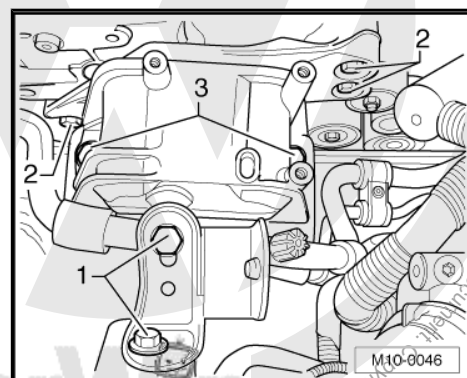
- If equipped, remove the battery jump start terminal on the front engine mount bolt using the Union Nut Socket - T40055- .
- Remove the right front wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner; Overview - Front Wheel Housing Liner .
- Remove the rear bolt -2- through the hole inside the wheel housing.



- Remove engine mount from above. Remove the bolt -1-, the front bolts -2- and the bolts -3-.

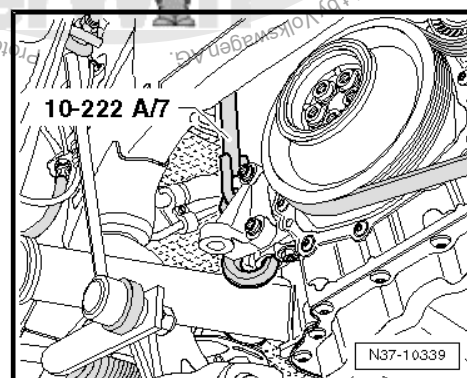
Installing

Install in reverse order of removal. Note the following:



Note

Disengage the Engine Support - Automatic Transmission Hook - 10-222A/7- from the cylinder block -image- and remove.



Tightening Specifications

- ◆ Refer to ➤ [“2.1 Overview - Subframe Mount”, page 22](#)
- ◆ Refer to ➤ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner; Overview - Front Wheel Housing Liner .

2.3 Engine, Supporting in Installed Position

Special tools and workshop equipment required

- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support - Automatic Transmission Hook - 10-222A/7-
- ◆ Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2-
- ◆ From the Engine Support - Basic Set - T40091-
- ◆ Engine Support - Supplement Kit Mount 5 - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-



- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

Tool Development

- If the adapter for Engine Support Bridge - Engine Support 4 - 10-222A/4- does not have the indicated holes -arrow- shown they must be added.
- Dimension -a- = 225 mm.
- Hole diameter = 12.5 mm

Procedure

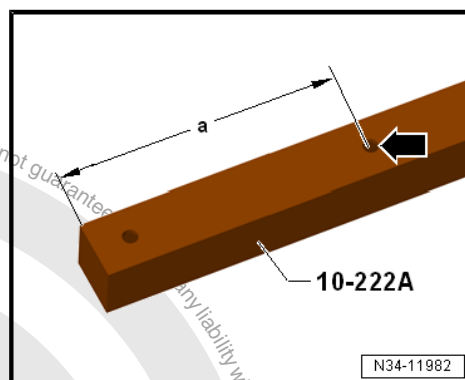
- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



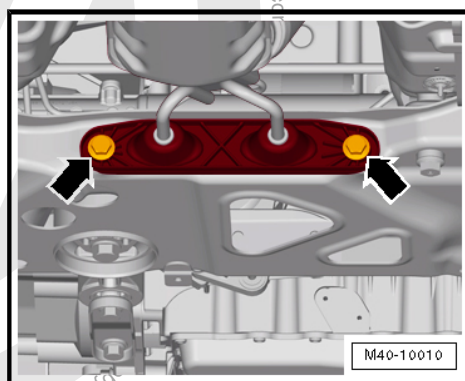
Caution

Danger of causing damage to the decoupling element:

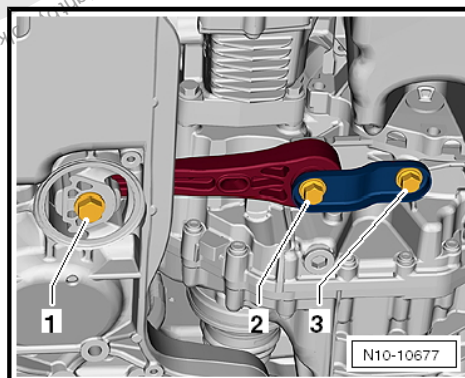
- ◆ ***Do not bend the decoupling element more than 10°.***
- ◆ ***Do not stretch the decoupling element.***
- ◆ ***Do not damage the wire mesh on the decoupling element.***



- Remove the exhaust system bracket from the subframe -arrows-.



- Remove the bolt -1-.
- Remove the bolts -2- and -3-.
- Remove the pendulum support.
- Remove the air filter housing (engine cover). Refer to ➤ ["3.2 Air Filter Housing, Removing and Installing"](#), [page 186](#) .



Vehicles with an Automatic Transmission

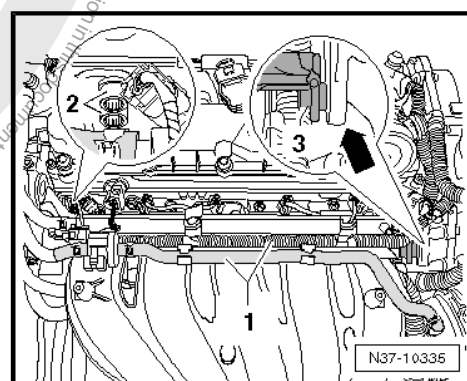
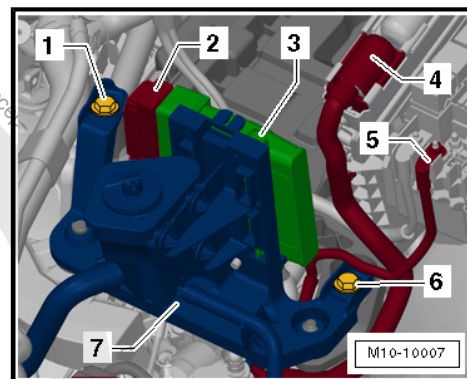


- Unclip the Transmission Control Module - J217- -3- from the bracket -7- and remove it.
- Disconnect the connector -2- from the Transmission Control Module - J217- .
- Remove the bolts -1- and -6-.
- Move the bracket -7- with the power steering fluid reservoir to the side. Be careful of the electric wires -4- and -5-.

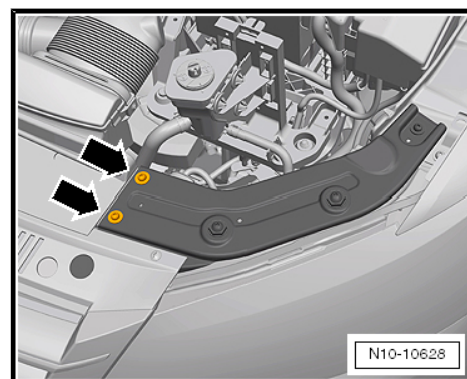
The hoses remain connected to the power steering fluid reservoir.

Continuation for All Vehicles

- Remove the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- Remove the plenum chamber cover. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Bulkhead; Plenum Chamber Cover, Removing and Installing .
- Remove the wires -1- from the transport strap -3-.
- Remove the transport strap -3- from the engine -2- and pull it out of the eye -arrow-.
- Insert a Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12- in this eye.

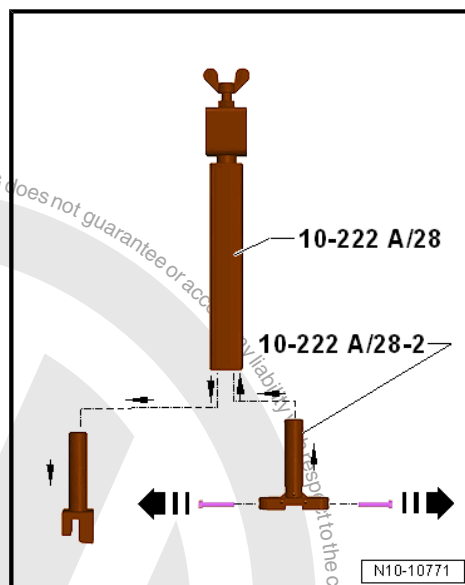


- Remove the bolts -arrows- from the left and right sides of the lock carrier bracket.





- Remove the lower mounts on the Engine Support Bridge - Engine Support 28 - 10-222A/28- and replace with the Engine Support Bridge - Engine Support 28 - 10-222A/28-2- .
- Remove the bolts in direction of -arrows- for securing the engine support bridge on the lock carrier from the Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2-

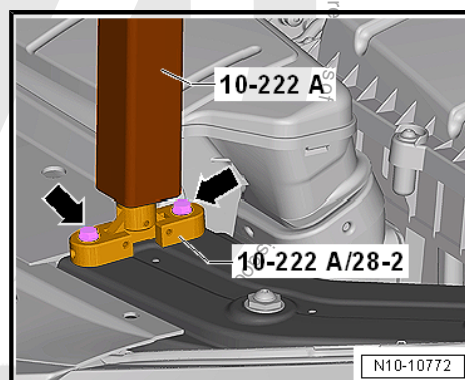


- Use the bolts from the Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- for attaching the Engine Support Bridge - Engine Support 28 - 10-222A/28- . Do not use the bolts for the bracket.
- Tighten the fastening bolts -arrows- to 8 Nm.



Caution

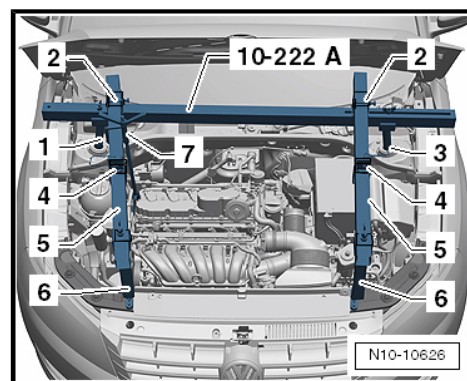
A second technician is needed when positioning the Engine Support Bridge - 10-222A- on the vehicle to keep the Engine Support Bridge from tipping.





Mount the engine support bridge on the engine/transmission sub-assembly as follows:

- 1 - Engine Support Bridge - Engine Support 31 Adapter 31-2 - 10-222A/31-2-
 - 2 - Engine Support - Basic Set - Moveable Joint - T40091/3-
 - 3 - Engine Support Bridge - Engine Support 31 Adapter 31-1 - 10-222A/31-1-
 - 4 - Movable Joint - T40093/4-
 - 5 - Engine Support - Basic Set - Square Pipe - T40091/1-
 - 6 - Engine Support Bridge - Engine Support 28 - 10-222A/28- with Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2-
 - 7 - Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- First slide the Movable Joints item - 2- onto the Square Pipe on the Engine Support Bridge - 10-222A- .
 - The bolts for the Movable Joints - T40091/3- item- 2- on the Engine Support Bridge -10-222A- point in the direction of travel.
 - Mount the Engine Support Bridge - 10-222A- on the suspension strut domes and have a second technician hold it to prevent it from falling over.
 - Slide the Square Pipe - T40091/1- item- 5- on the left and right sides through the Engine Support Bridge - Engine Support 28 - 10-222A/28- item- 6- from the front and position the Movable Joints - T40093/4- item- 4- on each side.
 - Additionally insert the Engine Support - Bracket w/Spindle and Hook - 10-222A/10- item- 7- on the right Engine Support - Basic Set - Square Pipe - T40091/1- .





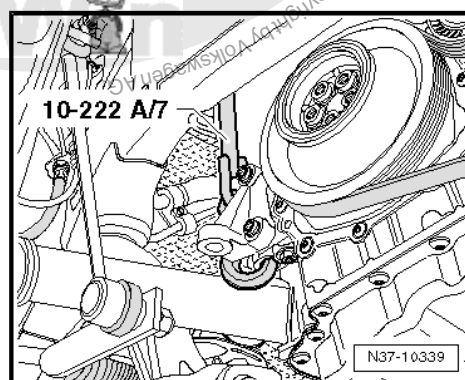
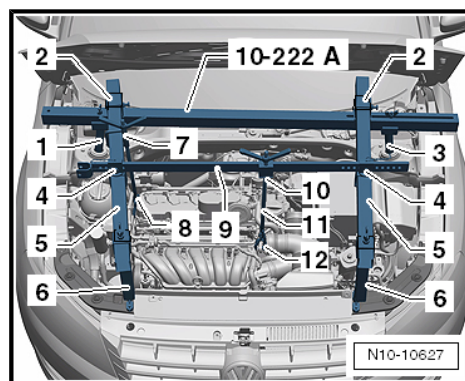
- Slide the Rail with Holes - T40091/2- item- 9- with the Support - Supplement Kit - Mount - T40093/5- item- 10- into the Moveable Joints - T40093/4- item- 4-.

- 1 - Engine Support Bridge - Engine Support 31 Adapter 31-2 - 10-222A/31-2-
- 2 - Engine Support - Basic Set - Moveable Joint - T40091/3-
- 3 - Engine Support Bridge - Engine Support 31 Adapter 31-1 - 10-222A/31-1-
- 4 - Movable Joint - T40093/4-
- 5 - Engine Support - Basic Set - Square Pipe - T40091/1-
- 6 - Engine Support Bridge - Engine Support 28 - 10-222A/28- with Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2-
- 7 - Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- 8 - Engine Support - Automatic Transmission Hook - 10-222A/7-
- 9 - Rail with Holes - T40091/2-
- 10 - Mount - T40093/5-
- 11 - Engine Support Bridge - Spindle - 10-222A/11-
- 12 - Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12-

- Insert the securing pin into the Rail with Holes - T40091/2- item- 9- and secure it with cotter pins.
- Tighten all threaded connections on the Engine Support Bridge hand-tight. While doing so, adjust the height of the Engine Support Bridge parallel over the Engine Support Bridge - Engine Support 28 - 10-222A/28-
- Extend the right Engine Support - Bracket w/Spindle and Hook - 10-222A/10- item -7- with the right Engine Support - Automatic Transmission Hook - 10-222A/7- item -8-.

The hooks from the Engine Support - Automatic Transmission Hook - 10-222A/7- point downward and will be engaged later in the cylinder block.

- Engage the left Engine Support Bridge - Spindle - 10-222A/11- item - 11- in the Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12- item - 12-.
- Position the spindles and hold the engine and transmission. Do not lift.



2.4 Subframe Mount, Adjusting

Special tools and workshop equipment required

- ♦ Engine Support Bridge - 10-222A-
- ♦ Engine Support - Automatic Transmission Hook - 10-222A/7-
- ♦ Engine Support - Bracket w/Spindle and Hook - 10-222A/10-



- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2-
- ◆ From the Engine Support - Basic Set - T40091-
- ◆ Engine Support - Supplement Kit Mount 5 - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

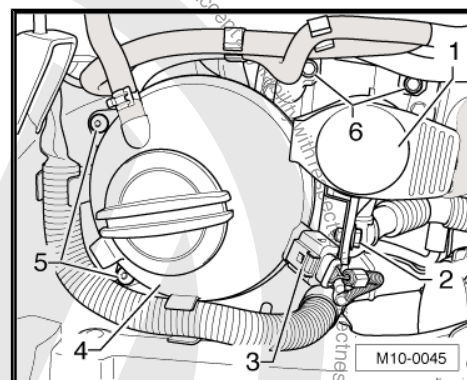


Note

- ◆ *It is not necessary to remove the battery and the battery tray if only the subframe mount on the engine side is being adjusted.*
- ◆ *Engine support bridge when adjusting the engine mount, without transmission mount. Refer to ⇒ ["2.2 Engine Mount, Removing and Installing", page 22](#) .*
- Support the engine with the transmission but do not lift it. Refer to ⇒ ["2.3 Engine, Supporting in Installed Position", page 27](#) .

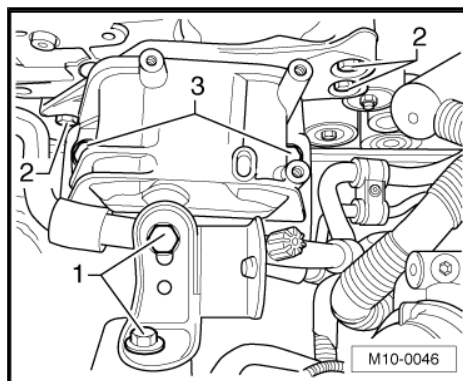
Engine Mount

- Remove the bolt -2- and move the windshield washer fluid reservoir filler tube forward -1-.
- Remove the bolts -5- and lay the coolant reservoir on the engine, with the hoses still connected.



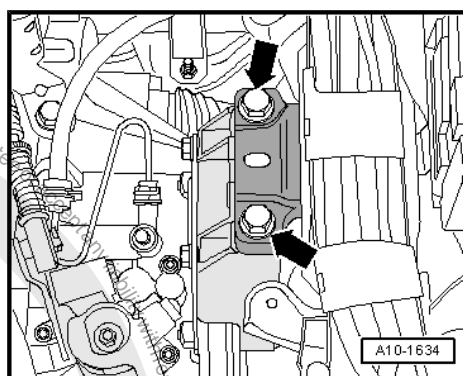


- Remove the bolts -1- and -3- from the engine mount.
- Replace the bolts on the subframe mount one after the other and tighten them hand-tight.



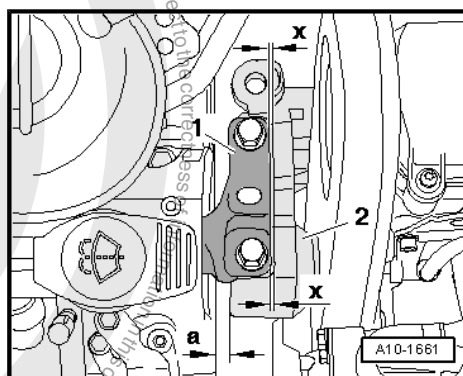
Transmission Mount

- Replace the assembly mount bolts -arrows- one after the other (if not already done) and tighten them by hand.
- Loosen left and right support arm bolts approximately two turns.



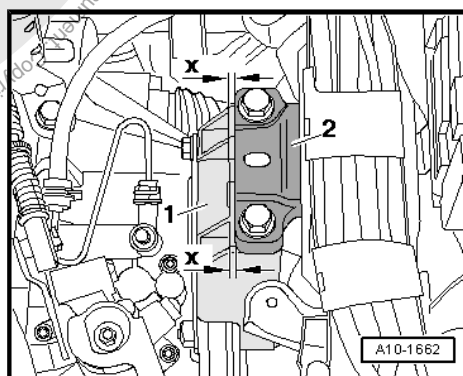
Engine Mount

- Between engine support and right longitudinal member, there must be clearance -a- 10 mm.
- The casting edge on the engine support -2- must be parallel to the support arm -1-; dimension -x- must be the same at the front and at the rear.



Transmission Mount

- Make sure that the edges on the support arm -1- and transmission mount -2- are parallel on the transmission side.
- Dimension -x- same size on both sides of bracket.



Continuation for All Vehicles:

Installation is performed in reverse order of the removal.

Tightening Specifications

- ◆ Refer to ➤ [“2.1 Overview - Subframe Mount”, page 22](#) .



2.5 Subframe Mount, Checking Adjustment

- There must be at least 10 to 13 mm -a- between engine support and right longitudinal member.
- The casting edge on the engine support -2- must be parallel to the support arm -1-; dimension -x- must be the same at the front and at the rear.

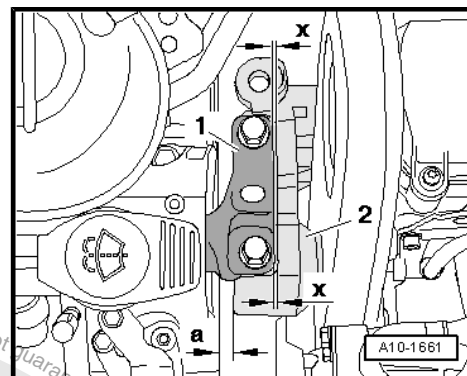


Note

Distance -a- can also be checked with a corresponding round stock.

Only if There is Noise (the Engine or Transmission Hitting the Longitudinal Member When Driving Around Curves) and Dimension -a- is not Within 10 to 13 mm:

- Adjust the subframe mount. Refer to
⇒ ["2.4 Subframe Mount, Adjusting", page 32](#) .





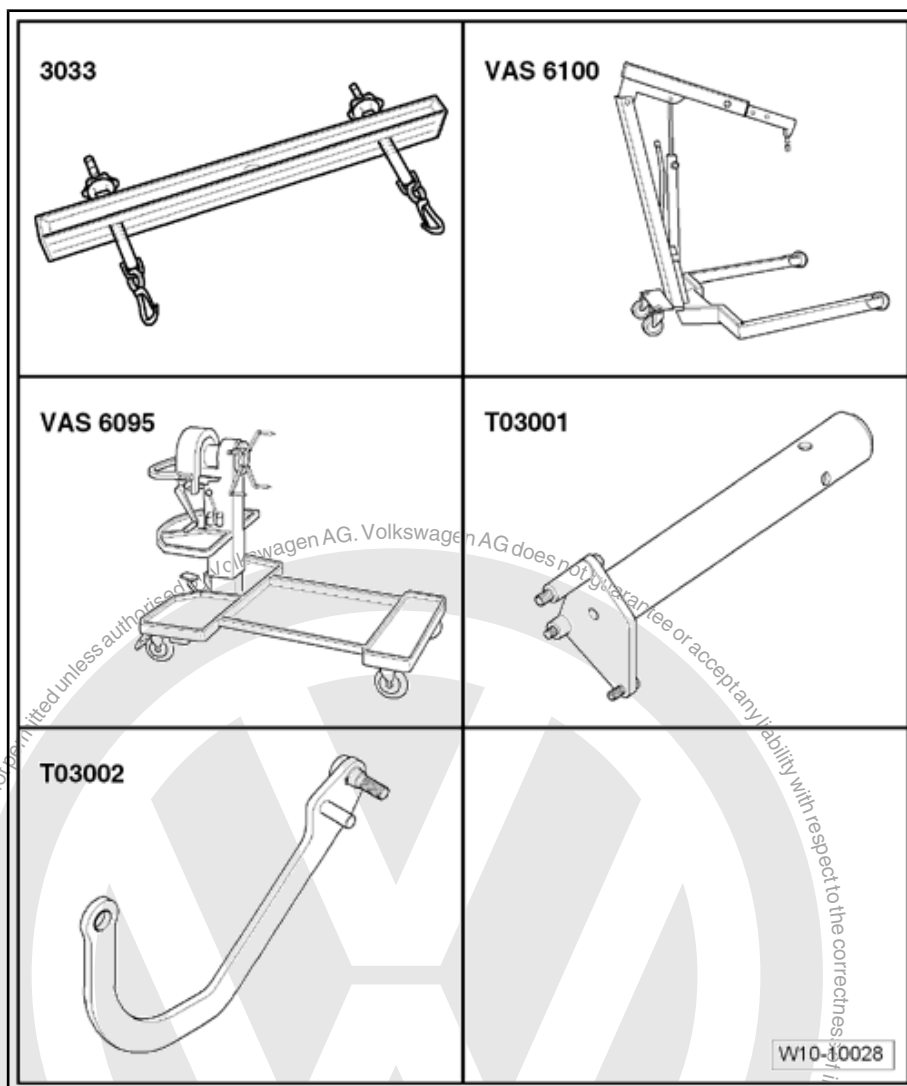
3 Engine Cover

- The engine cover and air filter housing are a single piece. Refer to
[⇒ "3.2 Air Filter Housing, Removing and Installing",
page 186](#) .

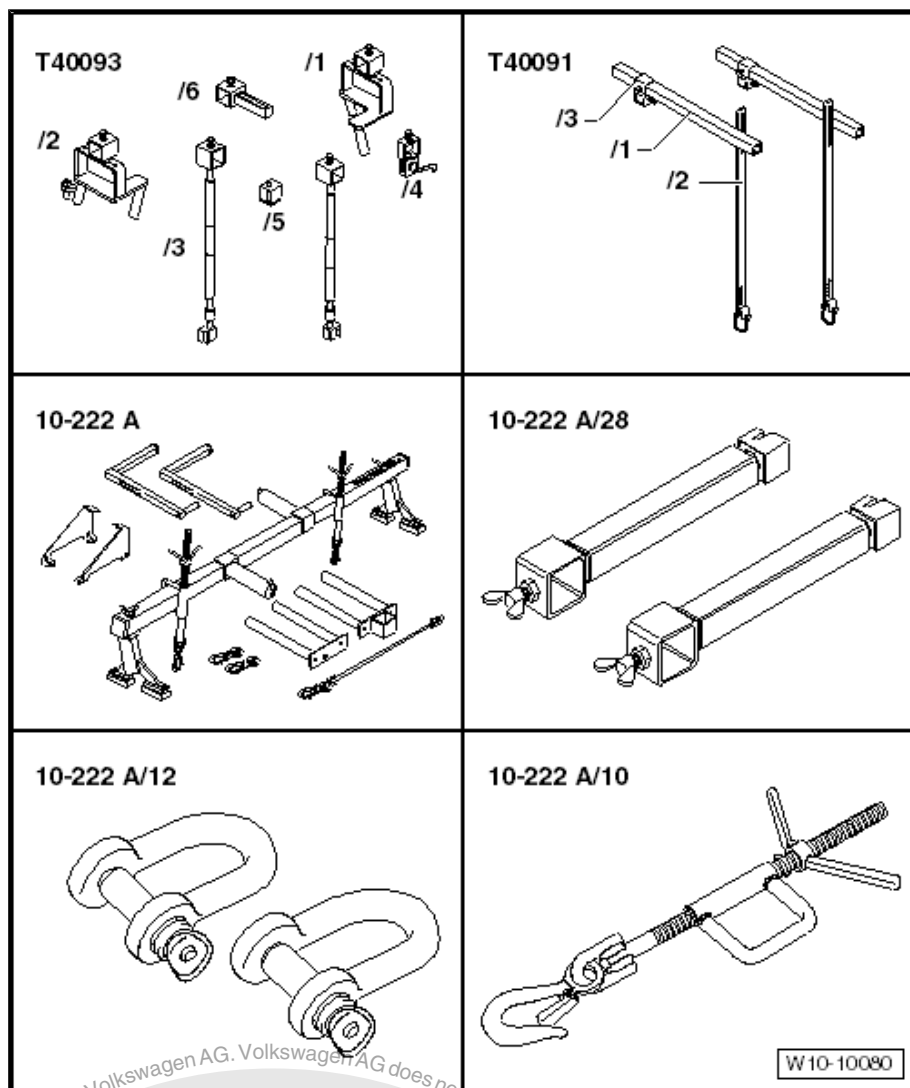




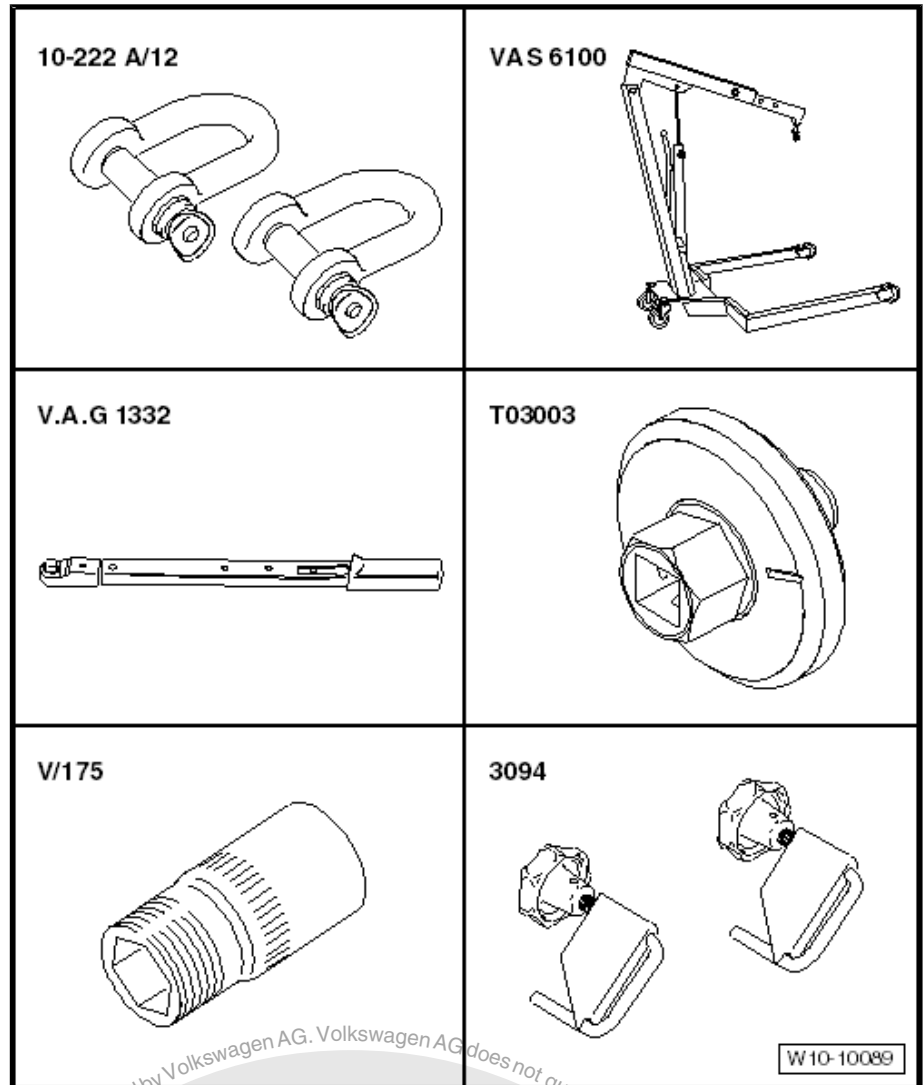
4 Special Tools



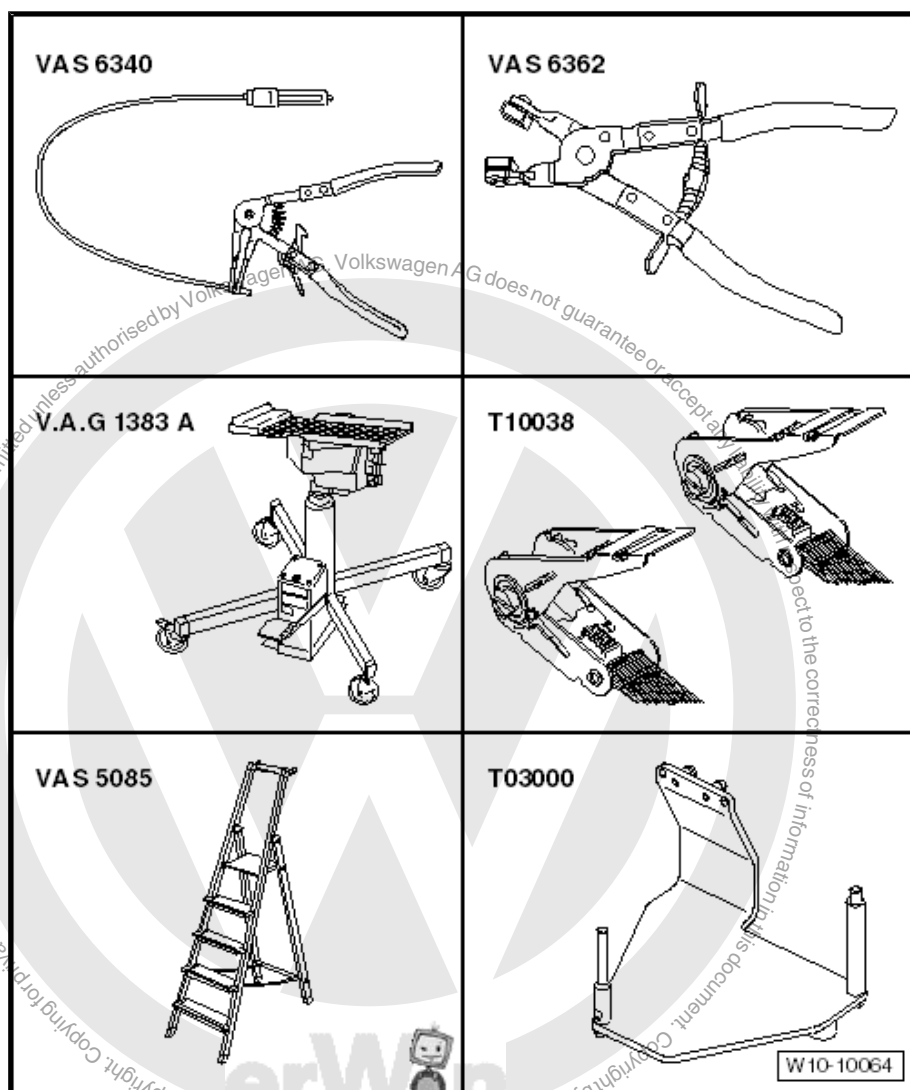
- ◆ Lifting Tackle - 3033-
- ◆ Shop Crane - VAS6100-
- ◆ Engine and Gearbox Bracket VAS6095A - VAS6095A-
- ◆ Engine And Transmission Holder - Engine Lateral Bracket - T03001-
- ◆ Transport Arm - T03002-



- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support - Automatic Transmission Hook - 10-222A/7-
- ◆ Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2- from Engine Support - Basic Set - T40091-
- ◆ Engine Support - Supplement Kit Mount 5 - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- , quantity: 2
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Basic Set - T40091-



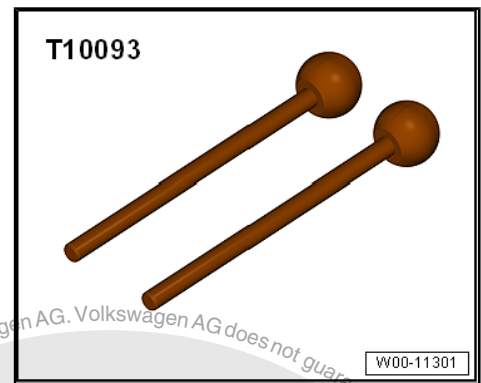
- ◆ Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12-
- ◆ Shop Crane - VAS6100-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Crankshaft Adapter - T03003-
- ◆ Socket - Sw15 - V/175-
- ◆ Hose Clamps - Up To 25mm - 3094- and Hose Clamps - Up To 40mm - 3093-



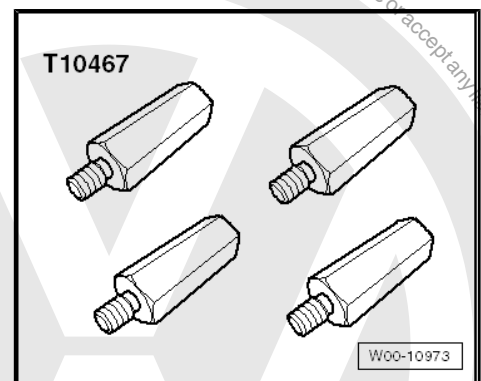
- ◆ Hose Clip Pliers - VAS6362-
- ◆ Hose Clip Pliers - VAS6362-
- ◆ Engine and Gearbox Jack - VAS6931-
- ◆ Tensioning Strap - T10038-
- ◆ Step Ladder
- ◆ Engine Holder Bracket - T03000-
- ◆ Cable Tie
- ◆ Foam Mat



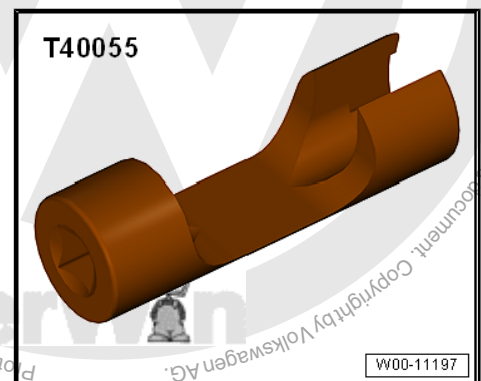
◆ Guide Pins - T10093-



◆ Adapters For Service Position - T10467-



◆ Union Nut Socket - T40055-





13 – Crankshaft, Cylinder Block

1 Cylinder Block, Belt Pulley Side

⇒ [“1.1 Overview - Ribbed Belt Drive”, page 42](#)

⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 45](#)

⇒ [“1.3 Ribbed Belt Tensioner, Removing and Installing”, page 46](#)

⇒ [“1.4 Vibration Damper, Removing and Installing”, page 47](#)

⇒ [“1.5 Sub-Assembly Bracket, Removing and Installing”, page 49](#)

⇒ [“1.6 Engine Bracket, Removing and Installing”, page 51](#)

⇒ [“1.7 Crankshaft Seal, Replacing, Belt Pulley Side”, page 51](#)

1.1 Overview - Ribbed Belt Drive

1 - Bolt

- 23 Nm

2 - Belt Pulley

- For power steering pump

3 - Bolt

- 23 Nm

4 - Power Steering Pump

- For power steering

5 - Sub-Assembly Bracket

Tightening specification and sequence. Refer to
⇒ [Fig. “Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence”](#), page 44 .

- Removing and Installing. Refer to
⇒ [“1.5 Sub-Assembly Bracket, Removing and Installing”, page 49](#) .

6 - Bolt

Tightening specification and sequence. Refer to
⇒ [Fig. “Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence”](#), page 44 .

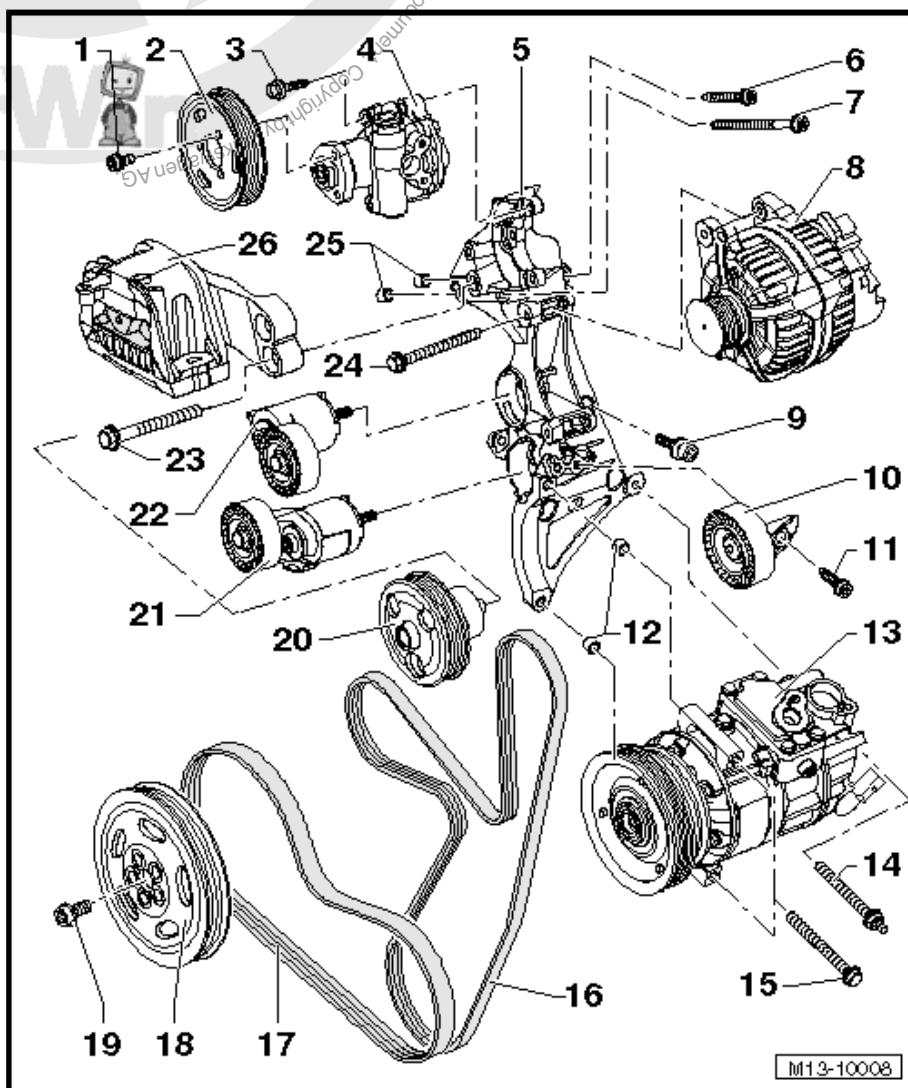
- There are different bolt lengths

7 - Bolt

Tightening specification and sequence. Refer to

⇒ [Fig. “Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence”](#), page 44 .

- There are different bolt lengths





8 - Generator

- ☐ Removing and installing. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Generator; Generator, Removing and Installing .
- ☐ To make it easier to position the generator, drive the threaded bushing for the generator bolt back slightly.

9 - Bolt

Tightening specification and sequence. Refer to

⇒ [Fig. "Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence" , page 44 .](#)

- ☐ There are different bolt lengths

10 - Bracket With Lower Relay Pulley

- ☐ For the A/C compressor ribbed belt
- ☐ Do not remove the idler roller.

11 - Bolt

- ☐ 25 Nm

12 - Bushing

- ☐ Quantity: 2

13 - A/C Compressor

- ☐ Removing and installing. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing .

14 - Double Bolt

- ☐ 25 Nm
- ☐ For attaching the power steering line

15 - Bolt

- ☐ 25 Nm

16 - Ribbed Belt for Generator, Vane Pump and Coolant Pump

- ☐ Ribbed belt routing. Refer to ⇒ [Fig. "Ribbed Belt Routing" , page 45](#)
- ☐ Before removing, mark direction of rotation using chalk or felt-tip marker
- ☐ Check for wear
- ☐ Do not kink
- ☐ Ribbed belt routing. Refer to ⇒ [Fig. "Ribbed Belt Routing" , page 45](#)
- ☐ Removing and Installing. Refer to ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 45 .](#)

17 - Ribbed Belt for A/C Compressor

- ☐ Ribbed belt routing. Refer to ⇒ [Fig. "Ribbed Belt Routing" , page 45](#)
- ☐ Before removing, mark direction of rotation using chalk or felt-tip marker
- ☐ Check for wear
- ☐ Do not kink
- ☐ Ribbed belt routing. Refer to ⇒ [Fig. "Ribbed Belt Routing" , page 45](#)
- ☐ Removing and Installing. Refer to ⇒ ["1.2 Ribbed Belt, Removing and Installing", page 45 .](#)

18 - Belt Pulley/Vibration Damper

- ☐ There are different versions
- ☐ To remove and install, secure the crankshaft. Refer to ⇒ ["3.2 Crankshaft, Locking", page 64](#)

19 - Bolts

- ☐ 50 Nm +90°
- ☐ Replace after removing
- ☐ Quantity: 5
- ☐ Use strength category 10.9 only

20 - Coolant Pump

- ☐ In cylinder block
- ☐ Removing and Installing. Refer to ⇒ ["2.2 Coolant Pump, Removing and Installing", page 157 .](#)



21 - Tensioner for A/C Compressor Ribbed Belt

- ☐ 35 Nm
- ☐ Do not remove the tensioning roller.
- ☐ Removing and Installing. Refer to ➤ [“1.3 Ribbed Belt Tensioner, Removing and Installing”, page 46](#) .

22 - Ribbed Belt Tensioner, Power Steering Pump and Coolant Pump

- ☐ 35 Nm
- ☐ Do not remove the tensioning roller.
- ☐ Replacing. Refer to ➤ [“1.3.2 Ribbed Belt Tensioner for Generator, Power Steering Pump and Coolant Pump, Removing and Installing”, page 47](#) .

23 - Bolt

- ☐ 40 Nm +90°
- ☐ Replace after removing

24 - Bolt

- ☐ 25 Nm

25 - Bushing

- ☐ Quantity: 2

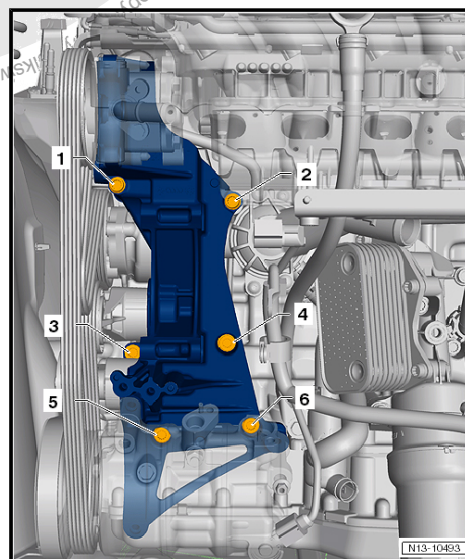
26 - Engine Mount

- ☐ Removing and Installing. Refer to ➤ [“2.2 Engine Mount, Removing and Installing”, page 22](#) .

Accessory Assembly Bracket - Tightening Specifications and Tightening Sequence

- Tighten new bolts in four stages in a -1- to -6- sequence as follows:

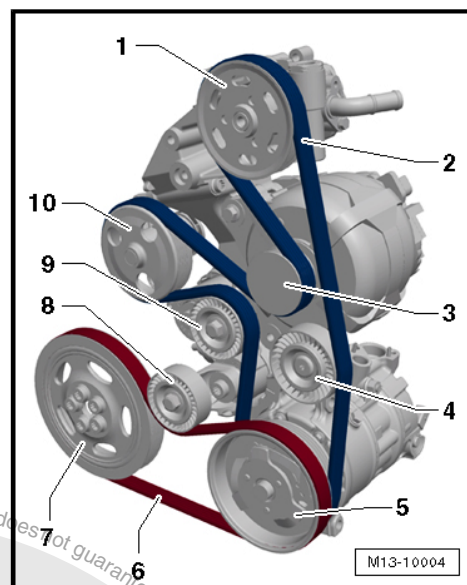
Step	Bolts	Tightening Specification/Additional Turn
1.	-5-	tighten by hand
2.	-1- through -6-	tighten by hand
3.	-1- through -6-	Tighten to 20 Nm
4.	-1- through -6-	Turn an additional 90°.





Ribbed Belt Routing

- 1 - Power Steering Pump
- 2 - Ribbed belt for generator, vane pump and coolant pump
- 3 - Belt pulley - generator
- 4 - Idler Roller
- 5 - Belt pulley - air conditioning compressor
- 6 - Ribbed belt for A/C compressor
- 7 - Belt pulley - crankshaft
- 8 - Tension roller for A/C compressor ribbed belt
- 9 - Tensioning roller for ribbed belt for generator, vane pump and coolant pump
- 10 - Belt pulley - coolant pump



1.2 Ribbed Belt, Removing and Installing

Special tools and workshop equipment required

- ◆ Locking Pin - T10060A-

Ribbed Belt, Removing

- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the right front wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner; Overview - Front Wheel Housing Liner .

Remove the A/C Compressor Ribbed Belt



Caution

Risk of damage due to reversed running direction on a used ribbed belt.

- ◆ ***Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.***

- Swivel the tensioner -1- as illustrated using a 15 mm wrench -A- in direction of -arrow- and secure using the Locking Pin - T10060A- .
- Remove ribbed belt for A/C compressor.

Removing the Ribbed Belt for the Generator, Power Steering Pump and Coolant Pump

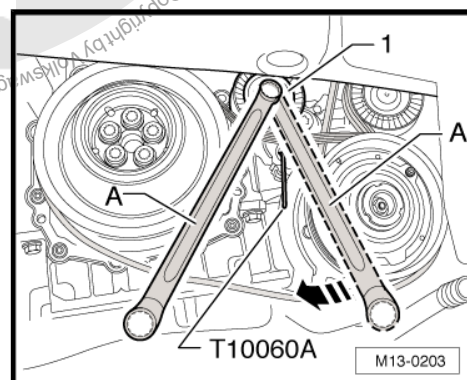


Caution

Risk of damage due to reversed running direction on a used ribbed belt.

- ◆ ***Before removing ribbed belt, marking running direction with chalk or felt-tip pen for reinstallation later.***

- Release the tension on the tensioner -1- for the A/C compressor ribbed belt (remove the Locking Pin - T10060A-).





- Insert the Locking Pin - T10060A- into the tensioner -2-.
- Swivel the tensioner -2- in direction of -arrow- using a 15 mm wrench -A- and then lock it into place with Locking Pin - T10060A- .
- Remove the generator ribbed belt, power steering pump and coolant pump.

Ribbed Belt, Installing

Install in reverse order of removal while noting the following:

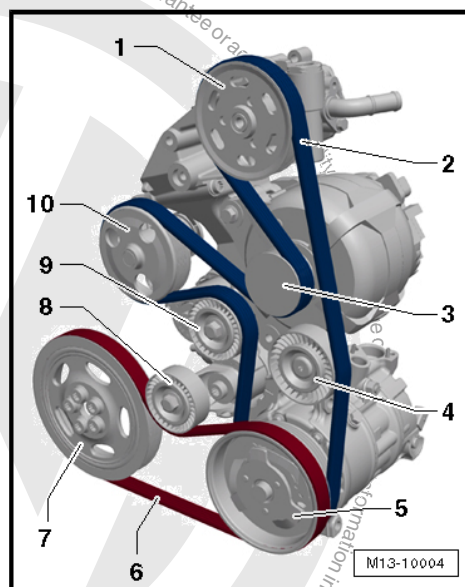
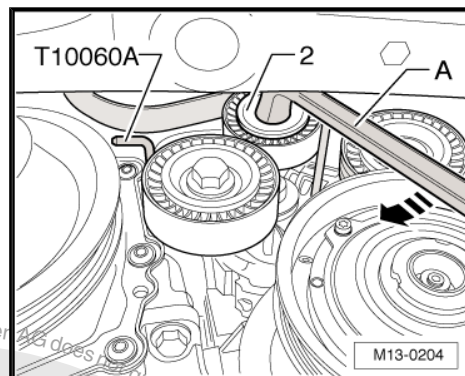
- Route the ribbed belt for the generator, power steering pump and coolant pump over the belt pulley, and then over the idler roller -4-.
- Turn the compressor ribbed belt pulley before tensioning the ribbed belt and make sure the ribbed belt is seated correctly on the belt pulley.
- Before installing ribbed belt for A/C compressor, secure tensioning device using the Locking Pin - T10060A- .



Note

Make sure the belt rotation direction is correct and that the belt sits correctly on the pulley.

- Start the engine and check the running belt. Refer to
⇒ [Fig. “Ribbed Belt Routing”](#), page 45 .



1.3 Ribbed Belt Tensioner, Removing and Installing

⇒ [“1.3.1 Ribbed Belt Tensioner, Removing and Installing, A/C Compressor”](#), page 46

⇒ [“1.3.2 Ribbed Belt Tensioner for Generator, Power Steering Pump and Coolant Pump, Removing and Installing”](#), page 47

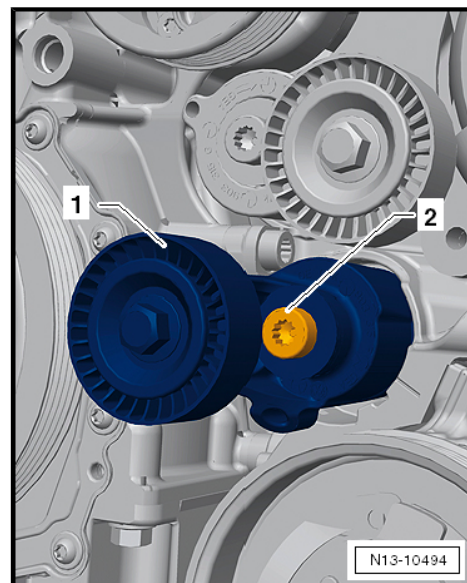
1.3.1 Ribbed Belt Tensioner, Removing and Installing, A/C Compressor

- Remove the ribbed belt. Refer to
⇒ [“1.2 Ribbed Belt, Removing and Installing”](#), page 45 .

- Loosen the bolt -2- and remove the tensioner -1-.
- Install in reverse order of removal. Note the following:

Tightening Specifications

Component	Nm
Tensioner to auxiliary components bracket	35 ± 5 Nm

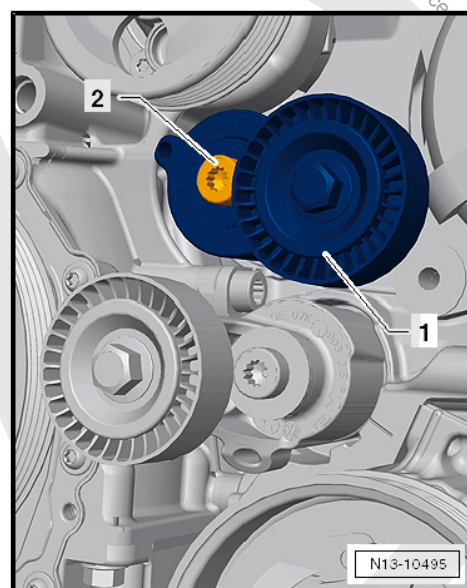


1.3.2 Ribbed Belt Tensioner for Generator, Power Steering Pump and Coolant Pump, Removing and Installing

- Remove the ribbed belt. Refer to [⇒ "1.2 Ribbed Belt, Removing and Installing", page 45](#).
- Loosen the bolt -2- and remove the tensioner -1-.
- Install in reverse order of removal. Note the following:

Tightening Specifications

Component	Nm
Tensioner to auxiliary components bracket	35 ± 5 Nm



1.4 Vibration Damper, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Crankshaft Adapter - T03003-
- ◆ Crankshaft Locking Pin - T40069-

Securing the crankshaft for valve timing inspection/adjustment.
Refer to [⇒ "3.2 Crankshaft, Locking", page 64](#).



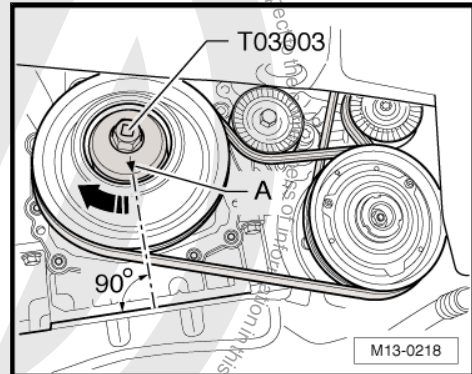
Procedure

- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the right front wheel housing liner. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner; Overview - Front Wheel Housing Liner .
- Attach the Crankshaft Adapter - T03003- on to belt pulley bolts.

The Crankshaft Adapter - T03003- can only be inserted correctly in one position.

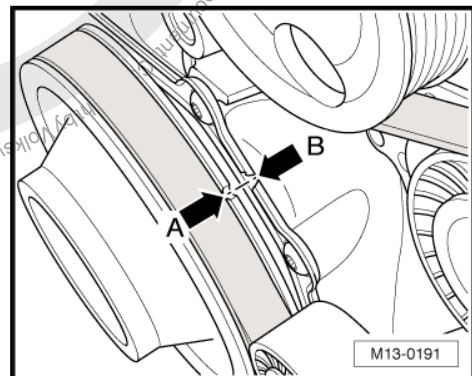
- Rotate the crankshaft in direction of engine rotation -arrow- far enough until arrow -A- on Crankshaft Adapter - T03003- points downward vertically, relative to the engine axis.

This position corresponds approximately to TDC position of crankshaft at cylinder 5.



Note

With engine removed, TDC marking can also be seen on belt pulley and sealing flange on belt pulley side. Notches -A- and -B- must align.



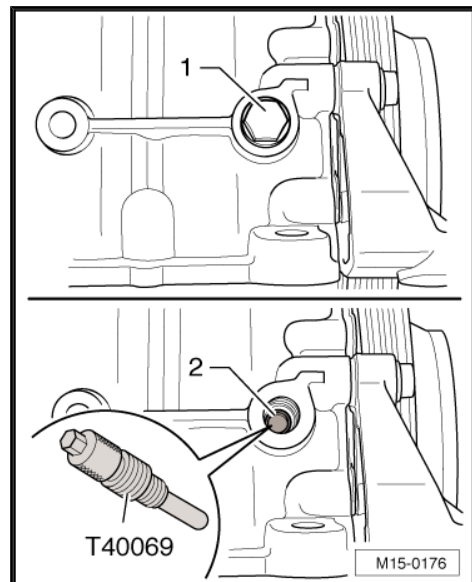
- Remove the sealing plug -1- on the back of the cylinder block.
- Look through the threaded hole. Make sure the hole -2- in the crankshaft is lined up with the threaded hole.

Use a mirror for this.

- Turn the crankshaft slightly, if necessary.
- When the holes line up, install the Crankshaft Locking Pin - T40069- all the way into the threaded hole and tighten it to 10 Nm. Make sure the crankshaft can be turned.
- Remove the A/C compressor ribbed belt. Refer to ➤ ["1.2 Ribbed Belt, Removing and Installing", page 45](#)
- Loosen the bolts on the vibration damper and remove the vibration damper.

After Assembly Work

- Remove the Crankshaft Locking Pin - T40069- and install the sealing plug -1- on cylinder block in the rear.

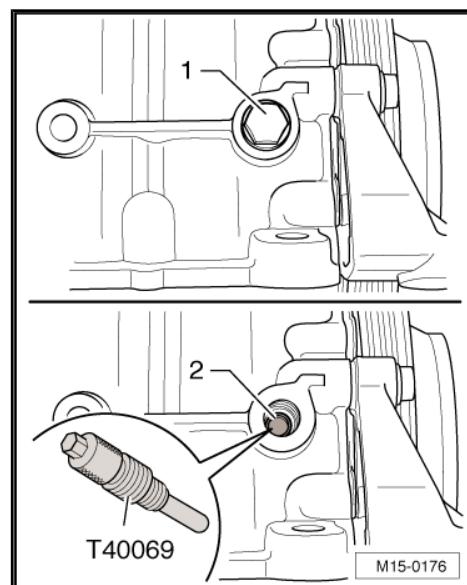




The rest of the installation follows the reverse of the removal procedures.

Tightening Specifications

- ◆ Refer to ⇒ [“1.1 Overview - Ribbed Belt Drive”, page 42](#)
- ◆ Refer to
 ⇒ [“1.3 Knock Sensor 1 G61 , Removing and Installing”, page 220](#)



1.5 Sub-Assembly Bracket, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-



Note

The sub-assembly bracket can be removed and installed without opening the refrigerant circuit.

Procedure

- Remove the engine mount. Refer to
 ⇒ [“2.2 Engine Mount, Removing and Installing”, page 22](#) .
- Remove the ribbed belt. Refer to
 ⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 45](#) .
- Remove the ribbed belt tensioner (A/C compressor). Refer to
 ⇒ [“1.3 Ribbed Belt Tensioner, Removing and Installing”, page 46](#) .
- Remove the ribbed belt tensioning damper (generator, power steering pump and coolant pump). Refer to
 ⇒ [“1.3.2 Ribbed Belt Tensioner for Generator, Power Steering Pump and Coolant Pump, Removing and Installing”, page 47](#) .



WARNING

Refrigerant can cause serious injury.

- ◆ *Do not open the A/C system refrigerant circuit.*





- Remove the A/C compressor from the auxiliary components bracket. Refer to ➤ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing .

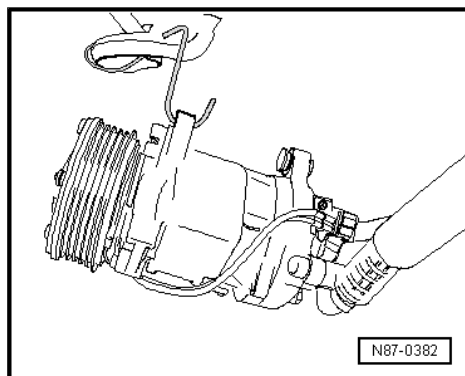
Securing A/C Compressor to Body



Caution

Danger of causing damage to the refrigerant lines and hoses.

- ◆ ***Do not bend, twist or stretch the refrigerant lines and hoses.***

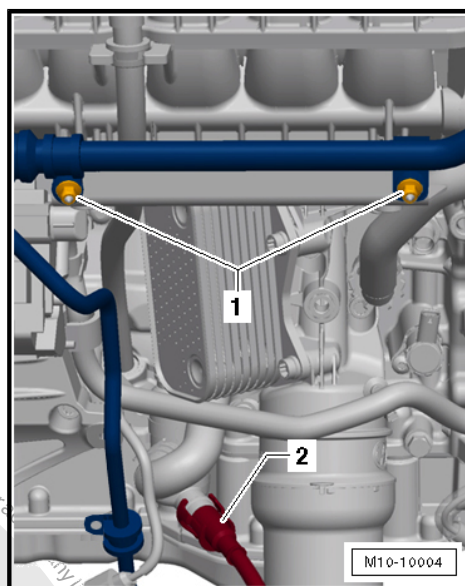


- Remove the generator. Refer to ➤ Electrical Equipment; Rep. Gr. 27 ; Generator; Generator, Removing and Installing .
- Remove the clamps for the power steering pressure line on the transmission. Refer to ➤ Suspension, Wheels, Steering; Rep. Gr. 48 ; Hydraulic Power Steering; Hydraulic Pipes and Reservoir Assembly Overview .
- Remove the nuts -1- and the power steering pump line.
- Remove the power steering pump from the auxiliary components bracket and move it forward. Refer to ➤ Suspension, Wheels, Steering; Rep. Gr. 48 ; Hydraulic Power Steering; Power Steering Pump, Removing and Installing .
- The power steering lines remain connected to the power steering pump.



Note

Note the different bolt lengths.





- Remove the bolts -1- through -6- and then remove the sub-assembly bracket from the cylinder block.

Installing

Install in reverse order of removal. Note the following:



Note

Note the different bolt lengths.

- Install the engine mount. Refer to
 ⇒ [“2.2 Engine Mount, Removing and Installing”, page 22](#) .
- Install the generator. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Generator; Generator, Removing and Installing .
- Attach the A/C compressor to the auxiliary components bracket. Refer to ⇒ Heating, Ventilation and Air Conditioning; Rep. Gr. 87 ; A/C Compressor; A/C Compressor, Removing and Installing .
- Install the ribbed belt tensioning damper (generator, power steering pump and coolant pump). Refer to
 ⇒ [“1.3.2 Ribbed Belt Tensioner for Generator, Power Steering Pump and Coolant Pump, Removing and Installing”, page 47](#) .
- Install the ribbed belt tensioner (A/C compressor). Refer to
 ⇒ [“1.3 Ribbed Belt Tensioner, Removing and Installing”, page 46](#) .
- Attach the power steering pump to the sub-assembly bracket. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 48 ; Hydraulic Power Steering; Power Steering Pump, Removing and Installing .
- Install the ribbed belt. Refer to
 ⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 45](#) .

Tightening Specifications

- ◆ Refer to ⇒ [“1.1 Overview - Ribbed Belt Drive”, page 42](#)

1.6 Engine Bracket, Removing and Installing

- The engine bracket is integrated inside the engine mount. Refer to
 ⇒ [“2.2 Engine Mount, Removing and Installing”, page 22](#) .

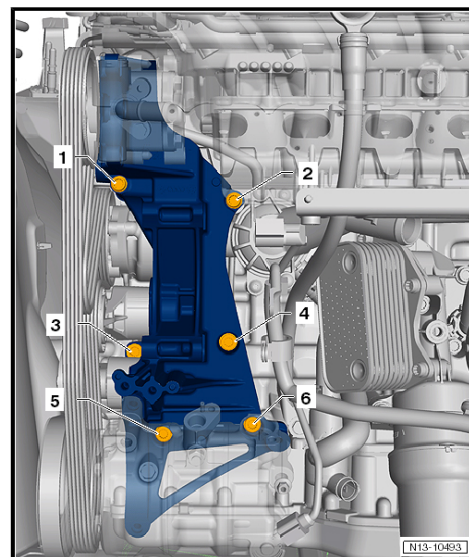
1.7 Crankshaft Seal, Replacing, Belt Pulley Side

Special tools and workshop equipment required

- ◆ Trim Removal Wedge - 3409-
- ◆ Oil Seal Guide Sleeve - T03004-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Silicone Sealant - D 174 003 A2-

Removing

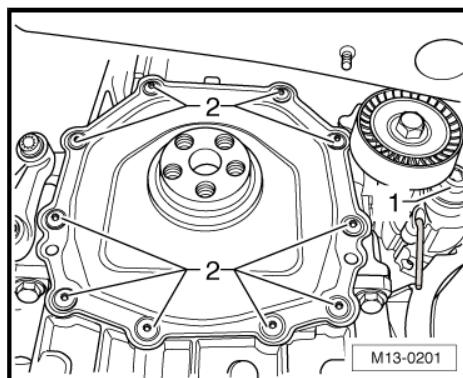
- Remove the A/C compressor ribbed belt. Refer to
 ⇒ [“1.2 Ribbed Belt, Removing and Installing”, page 45](#) .





- Secure the crankshaft. Refer to
⇒ ["3.2 Crankshaft, Locking", page 64](#) .
- Remove the belt pulley from the crankshaft.
- Remove the tensioner -1-. Refer to
⇒ ["1.3 Ribbed Belt Tensioner, Removing and Installing", page 46](#) .
- Remove the screws -2-.
- Begin pressing off the sealing flange -1- at the alignment sleeves -arrows- using a suitable screwdriver -A-.
- Use the Trim Removal Wedge - 3409- to support the screwdriver. This prevents damaging the sealing surface on the cylinder block.

Sealing flange is damaged while removing.



- Remove the sealing flange completely.

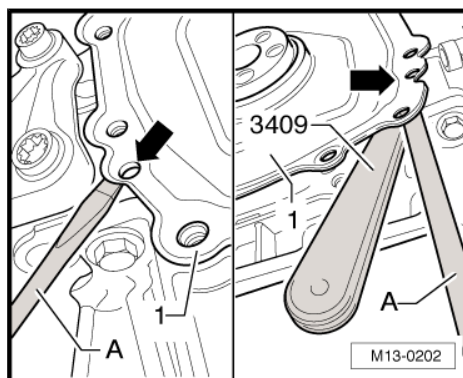
Installing



WARNING

To prevent injuries from shavings, wear protective goggles and protective clothing.

- Remove any sealant still on the cylinder block, for example, using a rotating plastic brush.



Caution

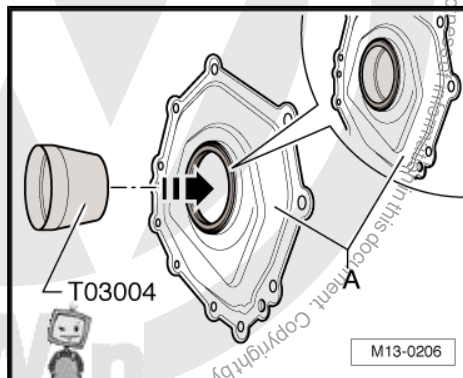
Make sure that no sealant residue gets into the engine.

- Clean the sealing surface on the cylinder block and on the crankshaft bearing pin. There must be no oil or grease on them.



Note

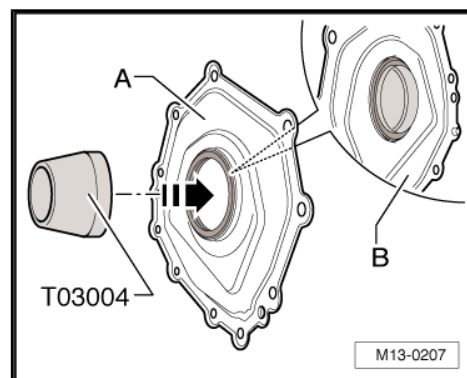
- ◆ *Do not additionally oil or grease sealing lip of sealing flange!*
- ◆ *The following work steps must be followed so that the sealing lip of sealing flange does not roll itself up when installing.*
- Widen the sealing lip on the new sealing flange using Oil Seal Guide Sleeve - T03004- , as illustrated.
The surface -A- is the outer side.





- Remove the Oil Seal Guide Sleeve - T03004- after a short while and push it into the seal rotated 180°.

The Oil Seal Guide Sleeve - T03004- must protrude approximately 3 mm on the inner side -B-.
 The surface -A- is the outer side.
 The surface -B- is the inner side (sealing surface).

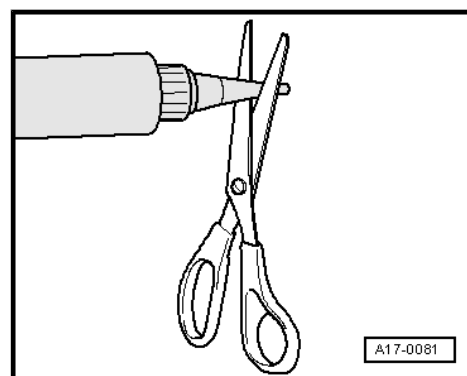


- Cut the tube nozzle at the front marking (nozzle diameter: approximately 2 mm).

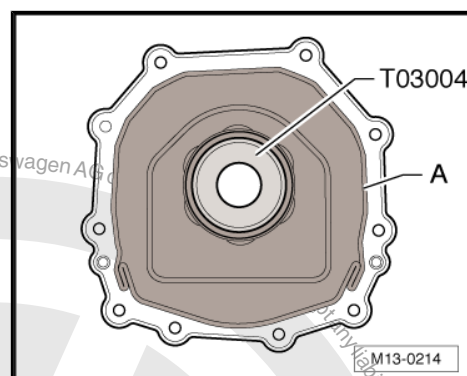


Note

The sealing flange for crankshaft -belt pulley side- must be installed within five minutes after application of sealant.



- Apply sealant bead -A- as illustrated into groove of sealing flange.
- ◆ Sealant bead width: 2.5 to 3.0 mm
- ◆ Seal bead height over the sealing surface: approximately 1.0 mm
- Insert sealing flange using Oil Seal Guide Sleeve - T03004- on crankshaft journals and press uniformly on the cylinder block.
- Tighten the bolts -A- diagonally and evenly.

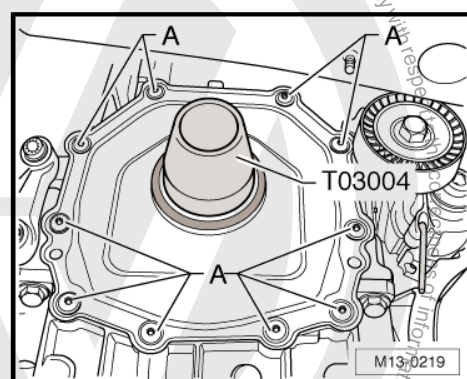


The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt.

Tightening Specifications

- ◆ Refer to
 ⇒ ["2.1 Overview - Cylinder Block, Transmission Side", page 54](#)
- ◆ Refer to
 ⇒ ["1.3 Knock Sensor 1 G61 Removing and Installing", page 220](#)



2 Cylinder Block, Transmission Side

⇒ ["2.1 Overview - Cylinder Block, Transmission Side", page 54](#)

⇒ ["2.2 Overview - Drive Plate", page 55](#)

⇒ ["2.3 Overview - Flywheel", page 56](#)

⇒ ["2.4 Drive Plate, Removing and Installing", page 56](#)

⇒ ["2.5 Flywheel, Removing and Installing", page 58](#)

⇒ ["2.6 Crankshaft Seal, Replacing, Transmission Side", page 58](#)

⇒ ["2.7 Sealing Flange, Removing and Installing, Transmission Side", page 59](#)

2.1 Overview - Cylinder Block, Transmission Side

1 - Belt Pulley/Vibration Damper

- ☐ There are different versions

2 - Bolts

- ☐ 50 Nm +90°
- ☐ Replace after removing
- ☐ Quantity: 5
- ☐ Use strength category 10.9 only

3 - Bolt

- ☐ 10 Nm

4 - Sealing Flange on Belt Pulley Side

- ☐ With integrated sealing ring
- ☐ Removing and Installing. Refer to
⇒ ["1.7 Crankshaft Seal, Replacing, Belt Pulley Side", page 51](#)

5 - Cylinder Block

6 - Bolt

- ☐ 60 Nm +90°
- ☐ Replace after removing

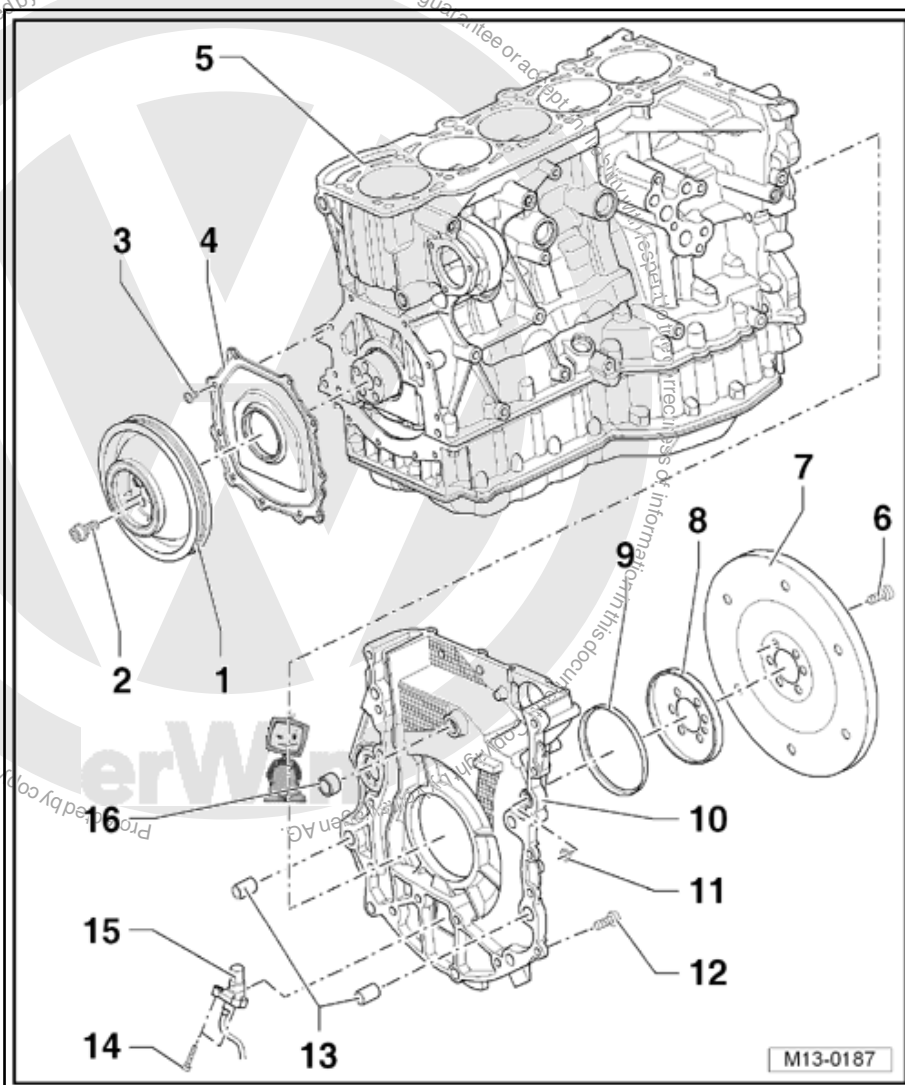
7 - Drive Plate/Flywheel

- ◆ To remove, secure crankshaft using the Crankshaft Locking Pin - T40069- .
- ◆ Flywheel must not be pried out or timing housing cover will be damaged

- ☐ Drive Plate, Removing and Installing. Refer to ⇒ ["2.4 Drive Plate, Removing and Installing", page 56](#) .

8 - Sensor Wheel

- ☐ For Engine Speed Sensor - G28-
- ☐ With position holder





9 - Sealing Ring - Transmission Side

- ☐ Removing and Installing. Refer to ⇒ [“2.6 Crankshaft Seal, Replacing, Transmission Side”, page 58](#) .

10 - Control Housing Cover

- ☐ Removing and Installing. Refer to
⇒ [“2.7 Sealing Flange, Removing and Installing, Transmission Side”, page 59](#) .

11 - O-Ring

- ☐ Replace after removing

12 - Bolt

- ☐ 25 Nm

13 - Alignment Sleeves

14 - Bolt

- ☐ 5 Nm

15 - Engine Speed Sensor - G28-

16 - Seal

- ☐ Replace after removing

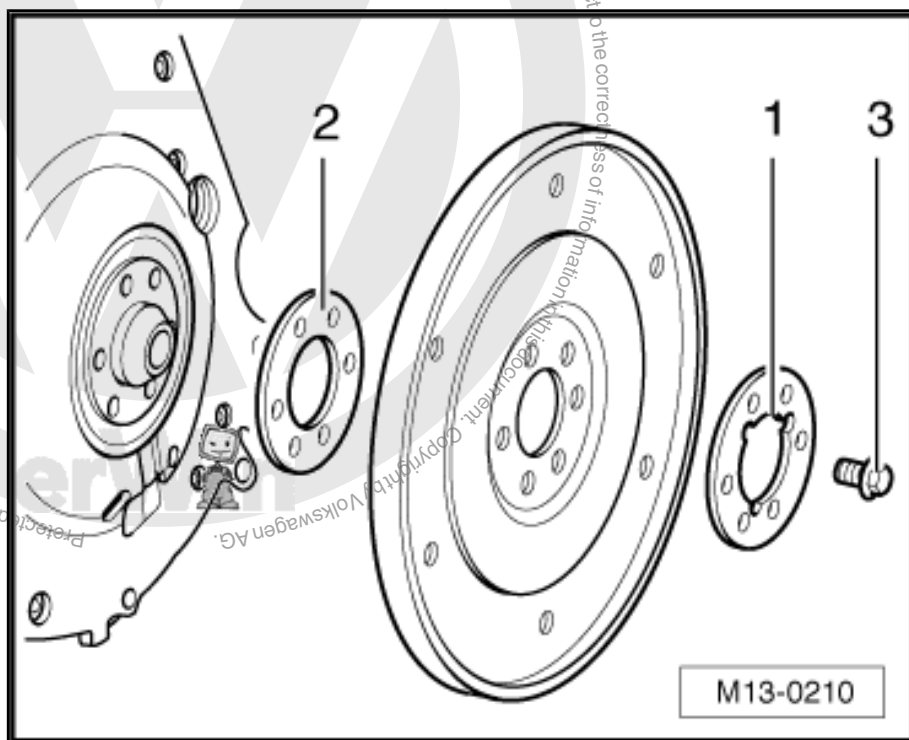
2.2 Overview - Drive Plate

1 - Washer with Recesses

2 - Shim

3 - Bolts

- ☐ Replace after removing
- ☐ Tightening specification. Refer to
⇒ [“2.4 Drive Plate, Removing and Installing”, page 56](#) .



- Install the drive plate only using the washer with openings
-1- without a shim -2-.

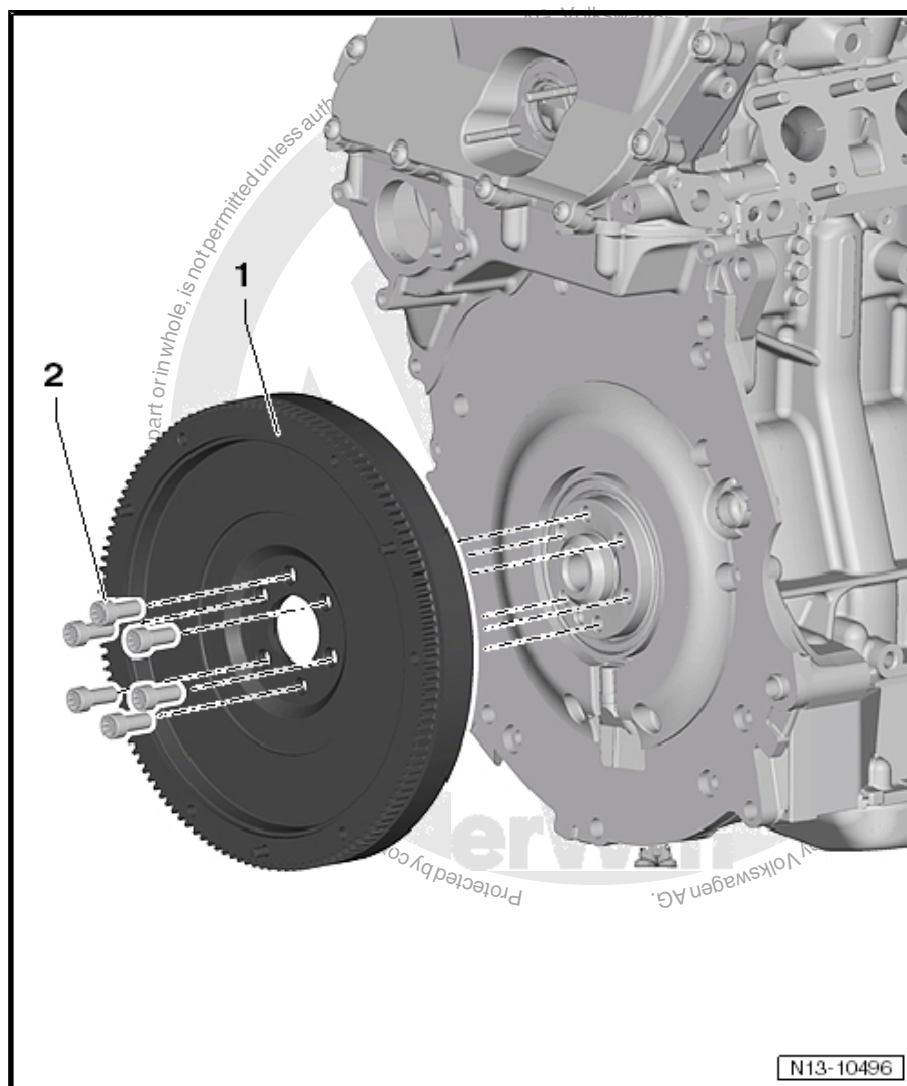


2.3 Overview - Flywheel

1 - Flywheel

2 - Bolts

- ☐ Replace after removing
- ☐ Tightening specification: 60 Nm + 90° additional turn.



2.4 Drive Plate, Removing and Installing

Special tools and workshop equipment required

- ◆ Depth Gauge

Work Steps	Specified Value Measurement	Tightening Specifications	Additional Turn
1. Replace the bolts 2. Tightening the bolts 3. Measuring. Refer to ⇒ “2.4 Drive Plate, Removing and Installing”, page 56 . 4. Tightening the bolts	18.8 to 20.4 mm	30 Nm 60 Nm	



Work Steps	Specified Value Measurement	Tightening Specifications	Additional Turn
5. Tightening the bolts with additional turn			90° additional turn (tightening can be done in stages).
6. Installing the sealing plug		Refer to ⇒ "1.3 Knock Sensor 1 G61, Removing and Installing" , page 220	

Removing

- Remove the transmission:

Manual transmission. Refer to ⇒ Rep. Gr. 34 ; Transmission, Removing and Installing .

Automatic transmission. Refer to ⇒ Rep. Gr. 37 ; Transmission, Removing and Installing .

- Lock the crankshaft and remove the drive plate.

Installing

- Install the drive plate only using the washer with openings -1- without a shim -2-.
- Install the new bolts -3- and tighten to 30 Nm.



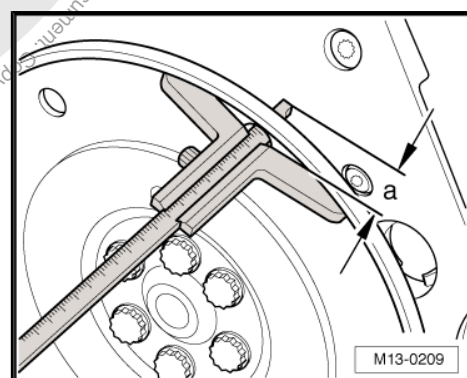
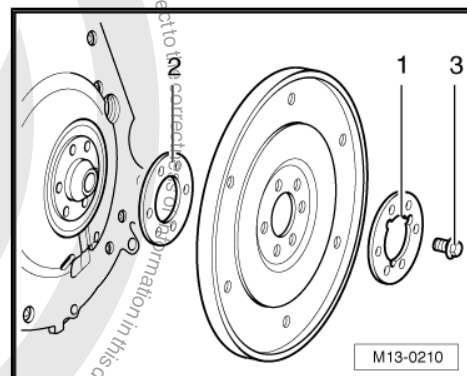
Note

Measure through drive plate hole to surface of control housing cover.

- Check dimension -a- at three points and calculate the average value.

Specified value: 18.8 to 20.4 mm

If the specification is not obtained:





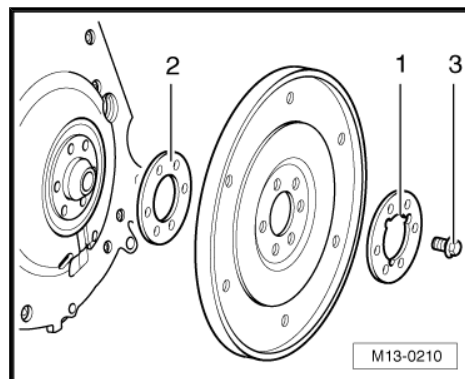
- Remove drive plate using the shim -2-. Tighten the bolts -3- again to 30 Nm and repeat the measurement.

If the specified value is OK:

- Tighten bolts to 60 Nm and turn an additional + 90° (1/4 rotation, additional rotation may occur in several stages).

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ♦ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt. Refer to ➔ [“1.3 Knock Sensor 1 G61, Removing and Installing”, page 220](#) .



2.5 Flywheel, Removing and Installing

Special tools and workshop equipment required

- ♦ Torque Wrench 1331 5-50Nm - VAG1331-
- ♦ Crankshaft Adapter - T03003-
- ♦ Crankshaft Locking Pin - T40069-

Removing

- Remove the transmission. Refer to ➔ [Rep. Gr. 34 ; Transmission, Removing and Installing](#) .
- Secure the crankshaft. Refer to ➔ [“3.2 Crankshaft, Locking”, page 64](#) .
- Mark flywheel to engine.
- Loosen the bolts -item 2- ➔ [Item 2 \(page 56\)](#) and remove the flywheel.

Installing

Install in reverse order of removal. Note the following:

- Use new bolts.

Tightening Specifications

- ♦ Refer to ➔ [“2.3 Overview - Flywheel”, page 56](#)

2.6 Crankshaft Seal, Replacing, Transmission Side

Special tools and workshop equipment required

- ♦ Seal Installer - Crankshaft - T10122A-
- ♦ Puller - Crankshaft/Power Steering Seal - T20143-

Removing

- Remove the transmission:
Manual transmission. Refer to ➔ [Rep. Gr. 34 ; Transmission, Removing and Installing](#) .
Automatic transmission. Refer to ➔ [Rep. Gr. 37 ; Transmission, Removing and Installing](#) .
- Secure the crankshaft. Refer to ➔ [“3.2 Crankshaft, Locking”, page 64](#) .
- Remove the flywheel and drive plate and then remove the sensor wheel for the Engine Speed Sensor - G28- from the crankshaft.



- Remove the gasket with the Puller - Crankshaft/Power Steering Seal - T20143/2- .

Be careful not to damage the sealing surface on the crankshaft.

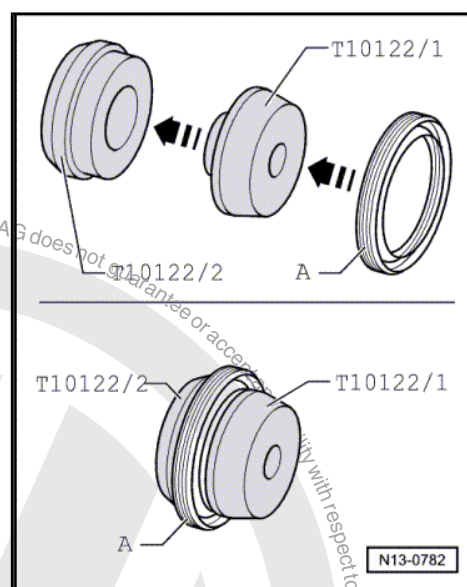
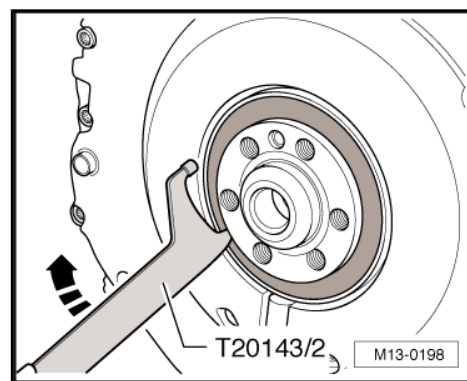
Installing



Note

Do not lubricate or grease the sealing lip on the seal.

- Clean the sealing surfaces. These must be free of oil and grease.
- Remove any oil residue on the crankshaft pins with a clean cloth.
- Place the Guide Piece - T10122/1- on the Seal Installer - Crankshaft - Pulling Sleeve - T10122/2- and slide the gasket -A- onto the pull sleeve.
- Remove the Guide Piece - T10122/1- .



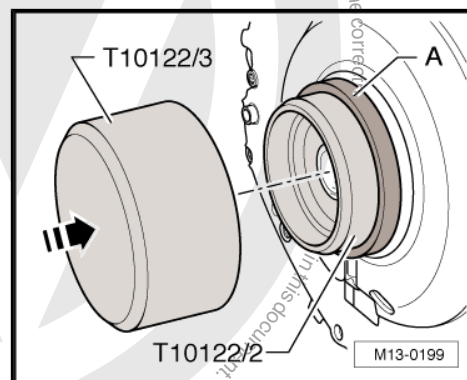
- Attach the Seal Installer - Crankshaft - Pulling Sleeve - T10122/2- and seal -A- on the crankshaft.
- Press in sealing ring all around evenly and flush using Seal Installer - Crankshaft - T10122/3- .

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt.

Tightening Specifications

- ◆ Refer to
 ⇒ ["2.1 Overview - Cylinder Block, Transmission Side", page 54](#)
- ◆ Refer to
 ⇒ ["1.3 Knock Sensor 1 G61, Removing and Installing", page 220](#)



2.7 Sealing Flange, Removing and Installing, Transmission Side

Special tools and workshop equipment required

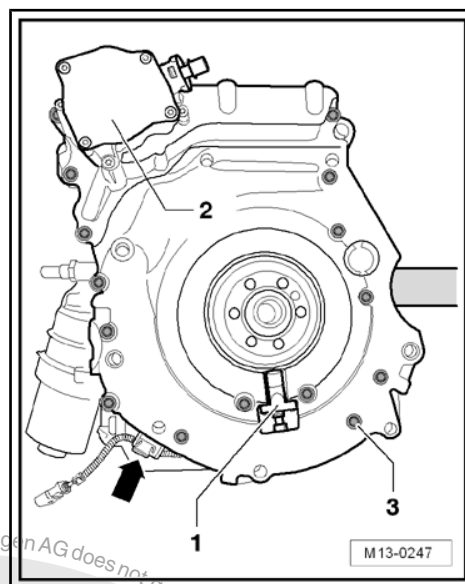
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-



- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Silicone Sealant - D 174 003 A2-

Removing

- Engine removed, transmission disconnected from flange
- Remove the timing chain cover. Refer to
⇒ ["2.1 Timing Chain Cover, Removing and Installing", page 92](#) .
- Remove the flywheel and drive plate and then remove the sensor wheel for the Engine Speed Sensor - G28- from the crankshaft.
- Remove the cylinder head. Refer to
⇒ ["1.3 Cylinder Head, Removing and Installing", page 83](#) .
- Disengage the electric wiring harness -arrow- and remove the Engine Speed Sensor - G28- -1- and vacuum pump -2-.
- Remove the bolts -3-.





- Remove the control housing cover -1- from the cylinder block -2- or from the oil pan lower section -3- on the upper and lower marked locations -A- using a screwdriver.

Start near the alignment sleeves -arrows-.



Note

Be careful not to damage the sealing surfaces.

- Remove the seal from the removed control housing cover.

Installing



WARNING

To prevent injuries from shavings, wear protective goggles and protective clothing.

- Remove the sealant residue from the cylinder block, oil pan upper section and control housing cover using a rotating plastic brush.



Caution

Make sure that no sealant residue gets into the engine.

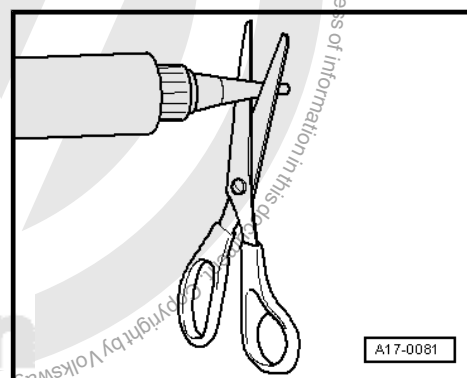
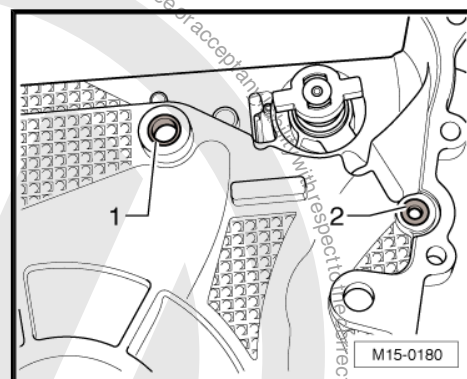
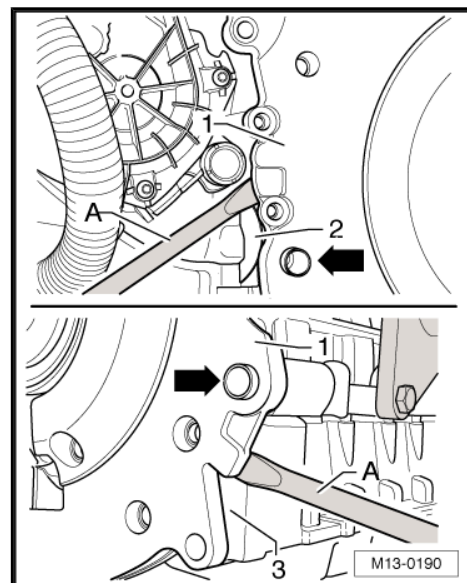
- Clean the sealing surfaces on the cylinder block, on the upper section of the oil pan and on the control housing cover. There must not be any oil or grease on them.
- Replace the seals -1- and -2-.

- Cut the tube nozzle at the front marking (nozzle diameter: approximately 1 mm).



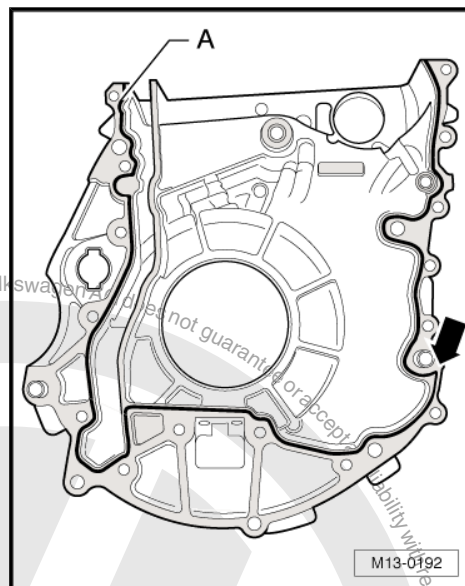
Note

The control housing cover must be installed within five minutes after application of sealant.





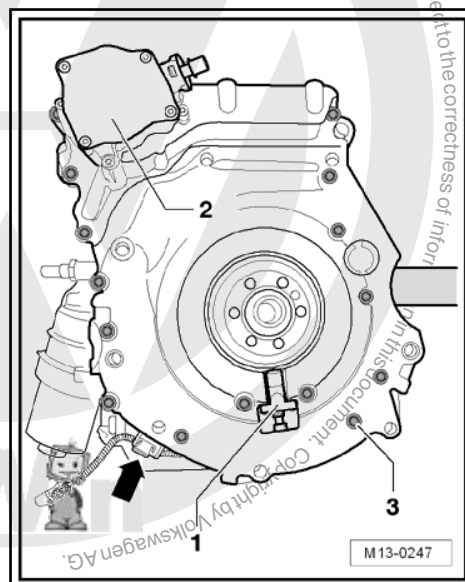
- Apply a bead of sealant -A- on the control housing cover as illustrated.
- ◆ The sealant bead must be 1.5 to 2.0 mm thick.
- ◆ Pay special attention to course of sealant bead in area -arrow-.
- Install the control housing cover so that the alignment sleeve fit into the holes in the cylinder block.
- Install the bolts hand-tight.



- Install the bolts -3- in the cylinder block and in the oil pan upper section and tighten to 10 Nm.
- Tighten the bolts in the cylinder block and oil pan upper section to 25 Nm.
- Wipe off any sealant that leaks out.
- Install the alignment sleeves all the way.
- Install a new seal. Refer to
⇒ ["2.6 Crankshaft Seal, Replacing, Transmission Side", page 58](#).

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ Install the brake booster vacuum pump. Refer to
⇒ ["1.5 Vacuum Pump, Removing and Installing", page 88](#).
- ◆ Install the cylinder head. Refer to
⇒ ["1.3 Cylinder Head, Removing and Installing", page 83](#).
- ◆ Install the drive plate. Refer to
⇒ ["2.4 Drive Plate, Removing and Installing", page 56](#).
- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt.
- ◆ Fill the coolant. Refer to
⇒ ["1.4 Coolant, Draining and Filling", page 147](#).



Tightening Specifications

- ◆ Refer to
⇒ ["2.1 Overview - Cylinder Block, Transmission Side", page 54](#)
- ◆ Refer to
⇒ ["1.3 Knock Sensor 1 G61, Removing and Installing", page 220](#)



3 Crankshaft

⇒ [“3.1 Overview - Crankshaft”, page 63](#)

⇒ [“3.2 Crankshaft, Locking”, page 64](#)

⇒ [“3.3 Crankshaft Dimensions”, page 66](#)

⇒ [“3.4 Main Bearing Shells Allocation”, page 66](#)

⇒ [“3.5 Crankshaft, Measuring Axial Play”, page 67](#)

⇒ [“3.6 Crankshaft, Measuring Radial Clearance”, page 67](#)

3.1 Overview - Crankshaft

1 - Bolt

- ☐ 40 Nm +90°
- ☐ Fully threaded
- ☐ Tighten to 40 Nm to measure the radial play in the crankshaft. Do not tighten any further.
- ☐ Replace after removing

2 - Bearing Cap

- ☐ Bearing cap 1: belt pulley side
- ☐ Retaining tabs of bearing shells and cylinder block/bearing caps must lie above one another

3 - Bearing Shell for Bearing Cap

- ☐ Without oil groove
- ☐ Do not interchange used bearing shells (label)

4 - Crankshaft

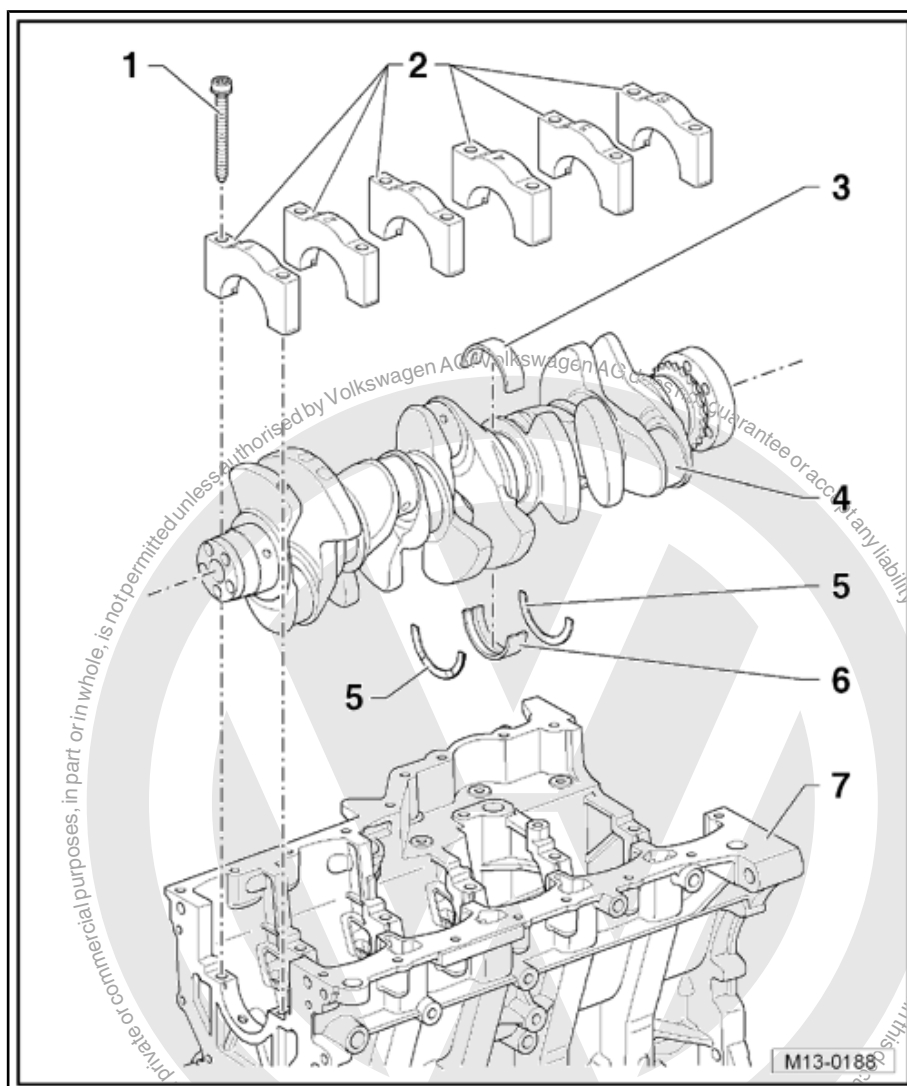
- ☐ Axial play new: 0.07 to 0.21 mm
- Wear limit: 0.30 mm.
- ☐ Measure the radial clearance with a Plastigage®.
- New: 0.023 to 0.043 mm
- wear limit: 0.07 mm
- ☐ Do not turn crankshaft when measuring radial clearance
- ☐ Crankshaft Dimensions. Refer to ⇒ [“3.3 Crankshaft Dimensions”, page 66](#)
- ☐ Secure the crankshaft. Refer to ⇒ [“3.2 Crankshaft, Locking”, page 64](#)

5 - Thrust Washers

- ☐ For bearing 3
- ☐ Side lubricating grooves face outward

6 - Cylinder Block Bearing Shell

- ☐ With oil groove





- ❑ Classification for replacement part ordering. Refer to ➤ [“3.4 Main Bearing Shells Allocation”, page 66](#)
- ❑ Do not interchange used bearing shells (label)

7 - Cylinder Block

3.2 Crankshaft, Locking

Special tools and workshop equipment required

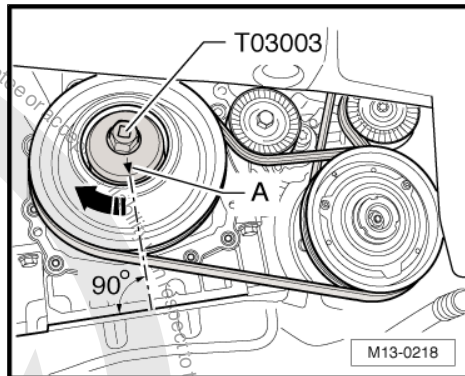
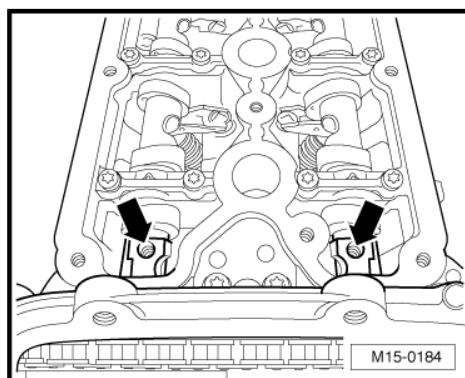
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Crankshaft Adapter - T03003-
- ◆ Crankshaft Locking Pin - T40069-
- Remove the cylinder head cover. Refer to ➤ [“1.4 Cylinder Head Cover, Removing and Installing”, page 87](#).



Note

If threaded holes in camshafts -arrows- do not stand upward, crankshaft must be rotated one rotation (360°) in direction of engine rotation.

In Order to be Able to Precisely Check and Adjust Valve Timing, Always Note the Following:





- ◆ Only turn crankshaft only in direction of engine rotation -arrow-. Do not rotate crankshaft back, not even slightly!
- ◆ Crankshaft must not be rotated out over the TDC marking. This means bore -2- in crankshaft must not stand above threaded opening.

If crankshaft was rotated out over the TDC marking:

- Turn the crankshaft back 45° opposite the direction of engine rotation.
- Turn the crankshaft again in direction of engine rotation to TDC

When the crankshaft is positioned slightly in front of the TDC position (hole in crankshaft is 90 % visible), the Crankshaft Locking Pin - T40069- can be screwed in, although slightly more difficult.

Procedure

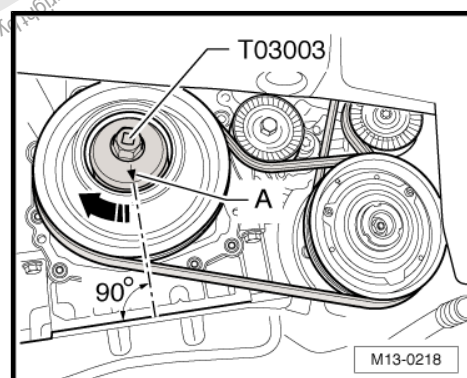
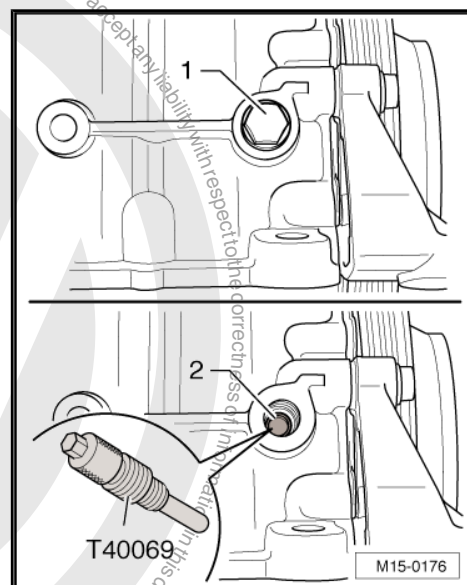
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the right front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner; Overview - Front Wheel Housing Liner .

- Attach the Crankshaft Adapter - T03003- on to belt pulley bolts.

The Crankshaft Adapter - T03003- can only be inserted correctly in one position.

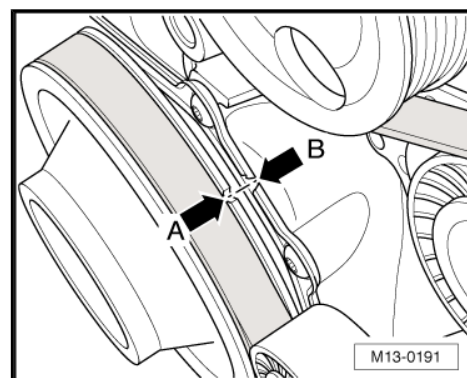
- Rotate the crankshaft in direction of engine rotation -arrow- far enough until arrow -A- on Crankshaft Adapter - T03003- points downward vertically, relative to the engine axis.

This position corresponds approximately to TDC position of crankshaft at cylinder 5.



Note

With engine removed, TDC marking can also be seen on belt pulley and sealing flange on belt pulley side. Notches -A- and -B- must align.

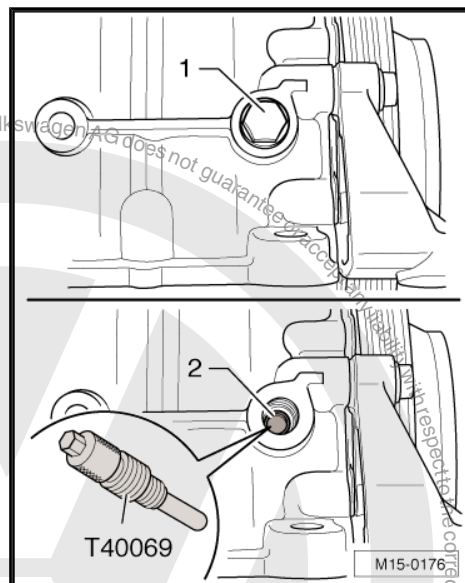




- Remove the sealing plug -1- on the back of the cylinder block.
- Look through the threaded hole. Make sure the hole -2- in the crankshaft is lined up with the threaded hole.

Use a mirror for this.

- Turn the crankshaft slightly, if necessary.
- When the holes line up, install the Crankshaft Locking Pin - T40069- all the way into the threaded hole and tighten it to 10 Nm.
- Make sure the crankshaft can be turned.



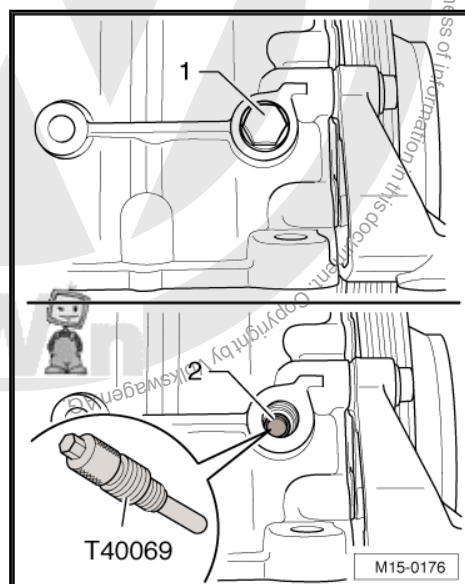
After Assembly Work

- Remove the Crankshaft Locking Pin - T40069- and install the sealing plug -1- on cylinder block in the rear.

The rest of the installation follows the reverse of the removal procedures.

Tightening Specifications

- ♦ Refer to
⇒ ["1.3 Knock Sensor 1 G61, Removing and Installing", page 220](#)



3.3 Crankshaft Dimensions

(Dimensions in mm)

Honing Dimension	Crankshaft Bearing Pin Diameter		Connecting Rod Bearing Pin Diameter	
Standard dimension	58.00	-0.022 -0.042	47.80	-0.022 -0.042
1st oversize	57.75	-0.022 -0.042	47.55	-0.022 -0.042
2nd oversize	57.50	-0.022 -0.042	47.30	-0.022 -0.042
Stage III	57.25	-0.022 -0.042	47.05	-0.022 -0.042

3.4 Main Bearing Shells Allocation

From the factory, the upper bearing shells are allocated to the cylinder block with the correct thickness. Colored dots serve to identify the bearing shell thickness.



The letters marked on the lower sealing surface of the cylinder block identify which bearing thickness must be installed in which location.

G - Yellow

B - Blue

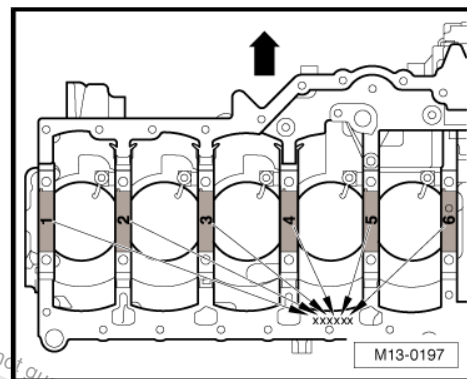
W - White

Crankshaft/upper Bearing Shell Marking



Note

- ◆ The -arrow- points in the direction of travel.
- ◆ Use the blue bearing shell if the color markings are not legible.
- ◆ The lower crankshaft bearing shells are always shipped as a replacement part with "yellow" markings.



3.5 Crankshaft, Measuring Axial Play

Special tools and workshop equipment required

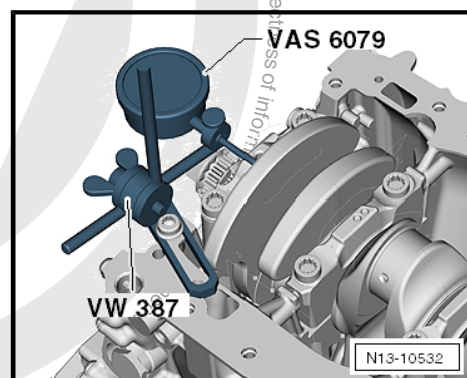
- ◆ Dial Gauge Holder - VW387-
- ◆ Dial Gauge - 0-10mm - VAS6079-

Test Sequence

- Attach the Dial Gauge - 0-10mm - VAS6079- with the Dial Gauge Holder - VW387- to the cylinder block and set indicator against crankshaft counterweight.
- Push the crankshaft against the Dial Gauge by hand and set the Dial Gauge to "0".
- Remove the crankshaft from the dial gauge and read the measurement.

Axial play:

- New: 0.07 to 0.21 mm.
- Wear limit: 0.30 mm.



3.6 Crankshaft, Measuring Radial Clearance

Special tools and workshop equipment required

- ◆ Plastigage®

Conditions

- Do not turn the crankshaft when checking the radial clearance.

Test Sequence



Note

- ◆ Do not interchange used bearings
- ◆ Bearing shells that are worn down to the nickel layer must be replaced.
- Remove the main bearing cap, clean the bearing cap and journal.



- Place the Plastigage® over the entire width of the bearing journal or in the bearing shells.
- Plastigage® must rest in center of bearing shell.
- Install and tighten the main bearing cover. Do not turn the crankshaft while doing this.
- Remove main bearing cap again.
- Compare width of Plastigage® with calibrated scale.

Radial clearance:

- New: 0.023 to 0.043 mm
- Wear limit: 0.07 mm



4 Piston and Connecting Rod

⇒ [“4.1 Overview - Piston and Connecting Rod”, page 69](#)

⇒ [“4.2 Pistons, Removing and Installing”, page 70](#)

⇒ [“4.3 Pistons and Cylinder Bore, Checking”, page 72](#)

⇒ [“4.4 New Connecting Rod, Separating”, page 73](#)

4.1 Overview - Piston and Connecting Rod



Note

*Engine is to be secured to the Engine And Transmission Holder
 - Engine Lateral Bracket - T03001- for performing assembly work.*

1 - Connecting Rod Bolt

- ☐ 30 Nm +90°
- ☐ Replace after removing
- ☐ Lubricate the thread and contact surface.
- ☐ Tighten to 30 Nm to measure radial play but do not tighten further.

2 - Relief Valve

- ☐ 27 Nm
- ☐ Opening pressure: 1.3 to 1.6 bar (18.85 to 23.2 psi) pressure

3 - Oil Spray Jet

- ☐ For piston cooling

4 - Connecting Rod Bearing Cap

- ☐ Note the installation position
- ☐ Due to the separation procedure (cracking) of the connecting rod, the cap only fits in one position and only to the corresponding connecting rod.
- ☐ Mark which cylinder to which it belongs -B-.
- ☐ Installed position: markings -A- face the pulley side

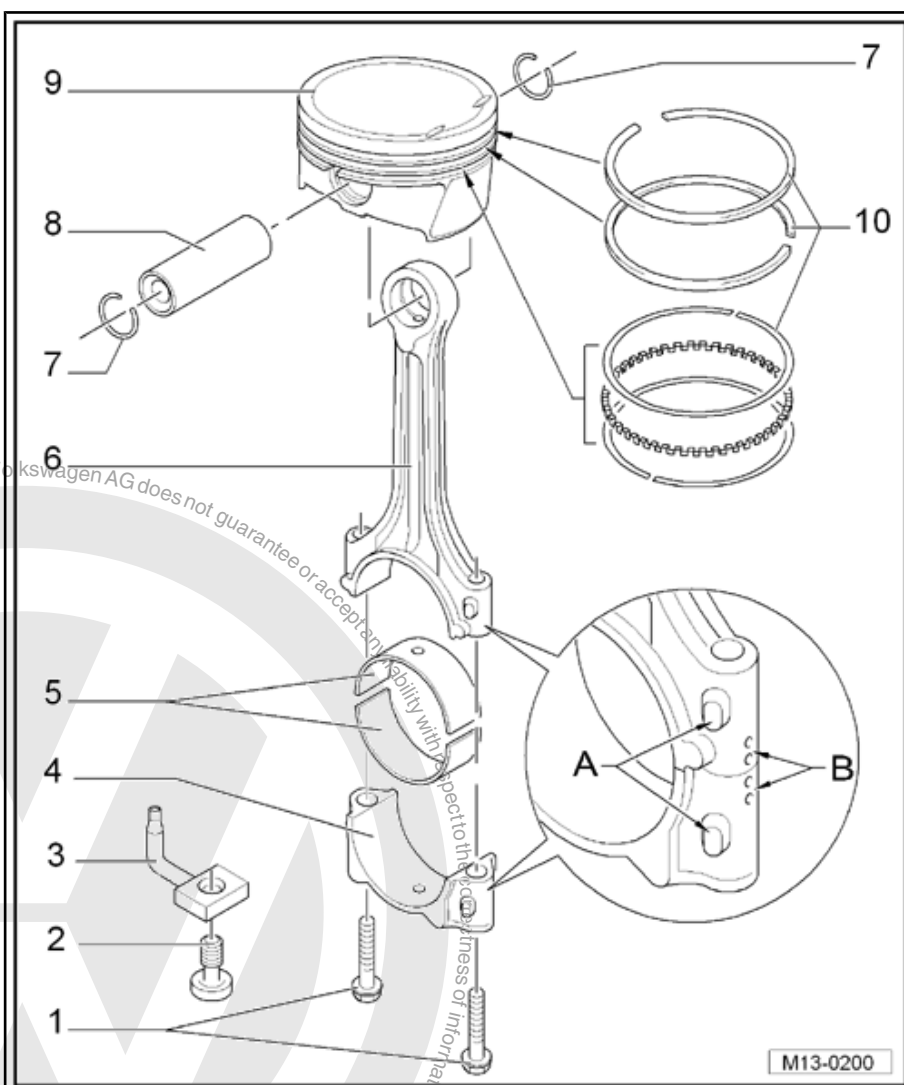
5 - Bearing Shell

- ☐ Note the installation position
- ☐ Do not interchange used bearing shells.
- ☒ New axial play: 0.10 to 0.35 mm

Wear limit: 0.4 mm

- ☐ Measure radial clearance with Plastigage®:

New; 0.02 to 0.06 mm





Wear limit: 0.09 mm.

Do not turn crankshaft when measuring radial play.

6 - Connecting Rod

- ☐ With cracked bearing cap
- ☐ New connecting rod, separating. Refer to ➔ [“4.4 New Connecting Rod, Separating”](#), page 73 .
- ☐ Always replace as a set.
- ☐ Mark which cylinder to which it belongs -B-.
- ☐ Installed position: markings -A- face the pulley side

7 - Circlip

8 - Piston Pin

- ☐ If difficult to move, heat piston to 60 °C (140 °F)
- ☐ Remove and install using the Pilot Drift - VW222A-

9 - Piston

- ☐ Checking. Refer to ➔ [Fig. “Pistons, Checking”](#), page 73 .
- ☐ Mark installed position and cylinder allocation
- ☐ Arrow on piston face points toward belt pulley side
- ☐ Install with piston ring compressor
- ☐ Checking the cylinder bore. Refer to ➔ [Fig. “Cylinder Bore, Checking”](#), page 73 .

10 - Piston Rings

- ☐ Offset gaps by 120°
- ☐ Use piston ring pliers for removing and installing
- ☐ Markings face toward piston crown
- ☐ Checking the ring gap. Refer to ➔ [Fig. “Checking the Piston Ring Gap”](#), page 72 .
- ☐ Checking the piston ring groove clearance. Refer to ➔ [Fig. “Piston Ring Groove Clearance, Checking”](#), page 72 .

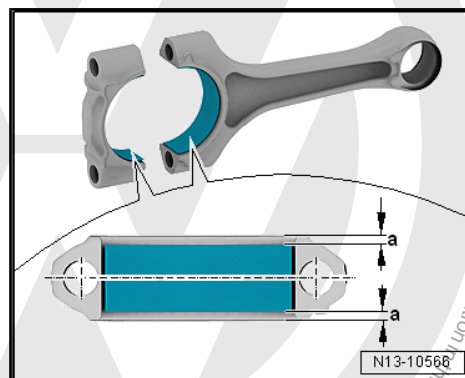
Bearing Shells Installed Position

Bearing shell -1- with connecting rod oil bore -arrow-.

Bearing shell -2- without oil bore for connecting rod cover.

- Place the bearing shells centrally into connecting rod and connecting rod bearing cap.

The dimension -a- must be the same at left and right.



4.2 Pistons, Removing and Installing

Special tools and workshop equipment required

- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Spring Clip Pliers - VAS6499-
- ◆ Polydrive Bit Drive Socket - T10070-
- ◆ Puller - Ignition Coil - T40039-
- ◆ Silicone Sealant - D 174 003 A2-



Removing

- Remove the engine. Refer to
 ⇒ [“1.1 Engine, Removing”, page 8](#) .
- Separate the engine and the transmission. Refer to
 ⇒ [“1.2 Engine and Transmission, Separating”, page 14](#) .
- Secure engine to the engine and transmission holder. Refer to
 ⇒ [“1.3 Engine, Securing on Engine and Transmission Holder”, page 18](#) .
- Remove the cylinder head. Refer to
 ⇒ [“1.3 Cylinder Head, Removing and Installing”, page 83](#) .
- Remove the oil pan upper section. Refer to
 ⇒ [“1.4 Oil Pan Upper Section, Removing and Installing”, page 126](#) .
- Mark the piston installation position and the cylinder to which the piston belongs.
- Mark installation position and connecting rod cylinder
 -item 6- ⇒ [Item 6 \(page 70\)](#) .
- Remove the connecting rod bearing cap and remove the piston and connecting rod upward.



Note

If difficult to move, heat pistons to approximately 60 °C (140 °F).

- Remove the locking ring from the eye of the piston pin.
- Remove the piston pin using the Pilot Drift - VW222A- .

Installing

Assembly is performed in reverse order of removal.



Note

- ◆ *Replace the bolts which have been tightened to torque.*
- ◆ *Arrow on the piston crown points toward belt pulley side.*
- ◆ *Piston ring gap offset 120°.*
- Coat the contact surfaces on the bearing shells with oil.
- Install the piston with a commercially available piston ring compressor. Pay attention to the installed position -item 9-
 ⇒ [Item 9 \(page 70\)](#) .
- Install the connecting rod bearing cap. Pay attention to the installed position -item 6- ⇒ [Item 6 \(page 70\)](#) .
- Install the oil pan upper section. Refer to
 ⇒ [“1.4 Oil Pan Upper Section, Removing and Installing”, page 126](#) .
- Install the cylinder head. Refer to
 ⇒ [“1.3 Cylinder Head, Removing and Installing”, page 83](#) .
- Attach the engine and the transmission. Refer to
 ⇒ [“1.2 Engine and Transmission, Separating”, page 14](#) .
- Install the engine. Refer to
 ⇒ [“1.1 Engine, Removing”, page 8](#) .

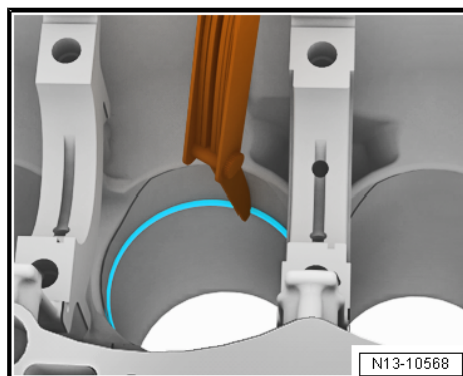


Tightening Specifications

- ◆ Refer to
⇒ ["4.1 Overview - Piston and Connecting Rod", page 69](#)

4.3 Pistons and Cylinder Bore, Checking

Checking the Piston Ring Gap



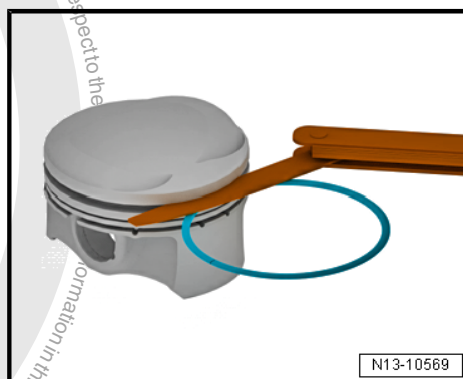
Special tools and workshop equipment required

- ◆ Feeler Gauge
- Insert the piston ring into the lower cylinder opening at a right angle from above approximately 15 mm away from the cylinder edge.

To do this use a piston without piston rings.

Piston Ring		Gap	
		New	Wear limit
Compression Rings	mm	0.20 to 0.40	0.8
Oil Scraping Ring	mm	0.25 to 0.50	0.8

Piston Ring Groove Clearance, Checking



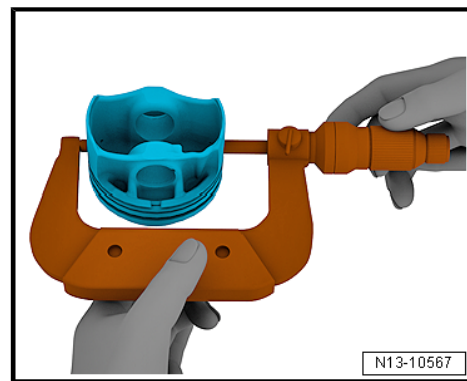
Special tools and workshop equipment required

- ◆ Feeler Gauge
- Clean the ring groove before checking.

Piston Ring		Ring to Groove Clearance	
		New	Wear limit
Compression Rings	mm	0.06 to 0.09	0.20
Oil Scraping Ring	mm	0.03 to 0.06	0.15



Pistons, Checking



Special tools and workshop equipment required

- ◆ Outside Micrometer - 75-100mm - VAS6071-
- Take measurement approximately 10 mm from lower edge of piston skirt and offset 90° to piston axis.

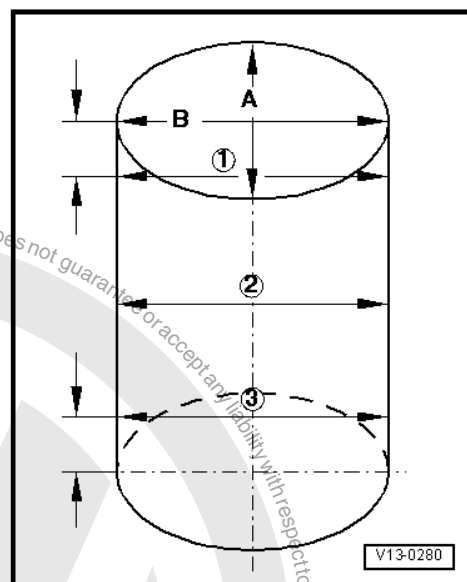
Deviations from the specified size: maximum 0.04 mm

Cylinder Bore, Checking



Note

Cylinder bore must not be measured if cylinder block is secured to engine stand with Engine And Transmission Holder - Engine Lateral Bracket - T03001- , or else results may be incorrect.



Special tools and workshop equipment required

- ◆ Cylinder Dial Bore Gauge - VAS6078-
- Measure diagonally at three positions laterally -A- and longitudinally -B-.

Deviation from specified size: maximum 0.08 mm

Piston and Cylinder Reconditioning Dimension

Honing Dimension		Piston Diameter	Cylinder Bore Diameter
Standard dimension	mm	82.465 ⁶⁾	82.51

6) The measurement does not include the graphite coating, which is 0.02 mm thick. The graphite coating wears off.

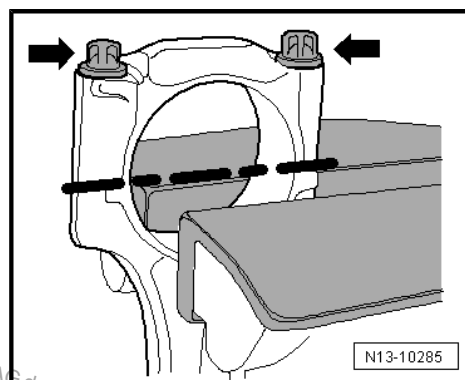
4.4 New Connecting Rod, Separating

New connecting rods might not be separated at the location where they should be. If the connecting rod bearing cap cannot be removed by hand, proceed as follows:

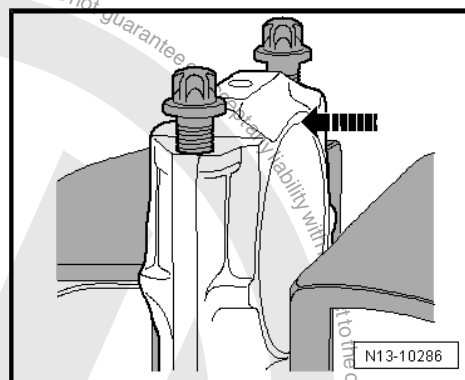


Note

- ◆ *Clamp the connecting rod lightly to prevent damaging it.*
- ◆ *Clamp the connecting rod below the dotted line.*
- Mark the cylinder where the connecting rod belongs.
- Lightly clamp the connecting rod in a vise equipped with aluminum protective pads.
- Loosen the bolts -arrows- approximately five turns.




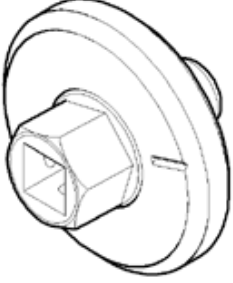
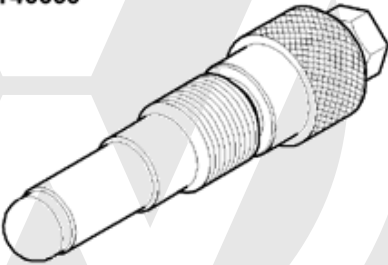
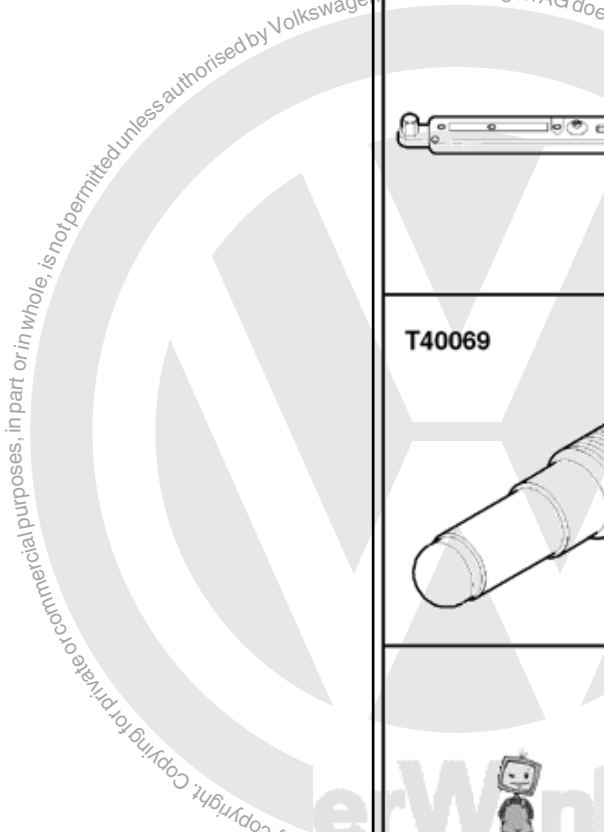
- Carefully tap against the connecting rod bearing cap in direction of -arrow- with a plastic hammer until the cap is loose.



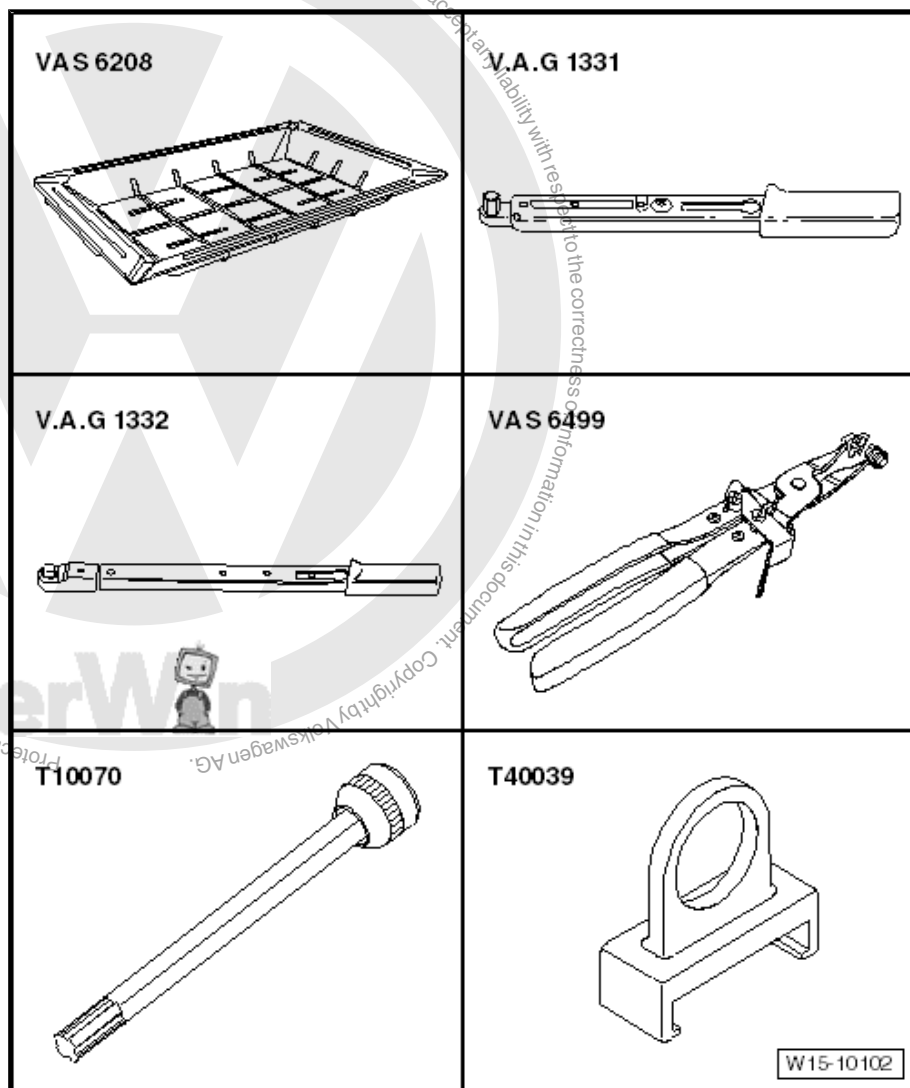


5 Special Tools

Special tools and workshop equipment required

<p>V.A.G 1331</p> 	<p>T03003</p> 
<p>T40069</p> 	
	<p>W13-10015</p>

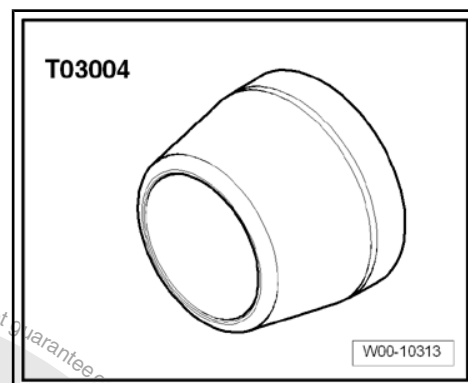
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Crankshaft Adapter - T03003-
- ◆ Crankshaft Locking Pin - T40069-



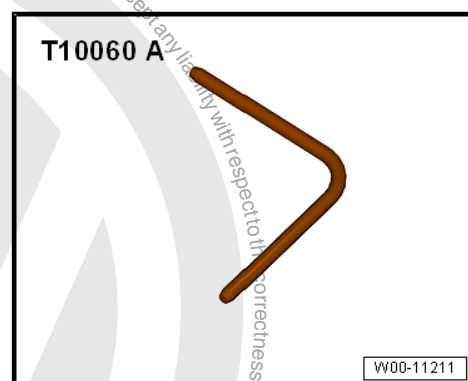
- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Spring Clip Pliers - VAS6499-
- ◆ Polydrive Bit Drive Socket - T10070-
- ◆ Puller - Ignition Coil - T40039-
- ◆ Silicone Sealant - D 174 003 A2-



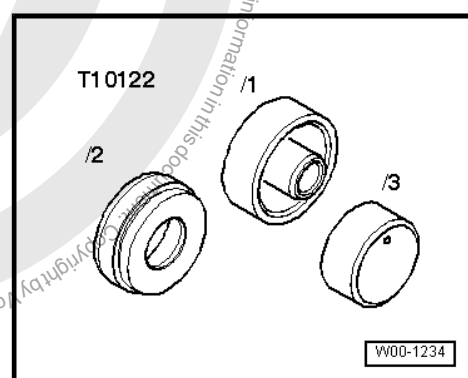
◆ Oil Seal Guide Sleeve - T03004-



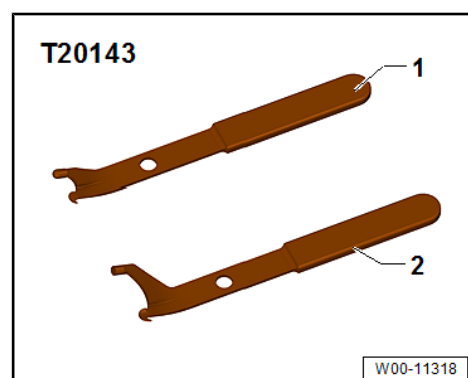
◆ Locking Pin - T10060A-



◆ Seal Installer, Crankshaft - T10122A-

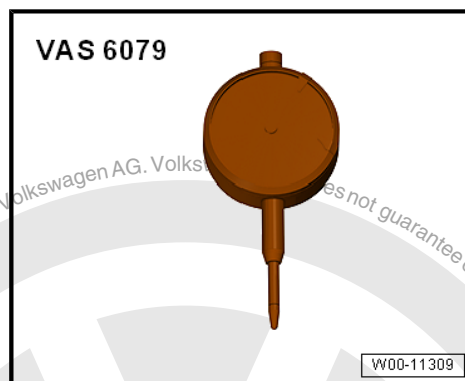


◆ Puller - Crankshaft/Power Steering Seal - T20143-

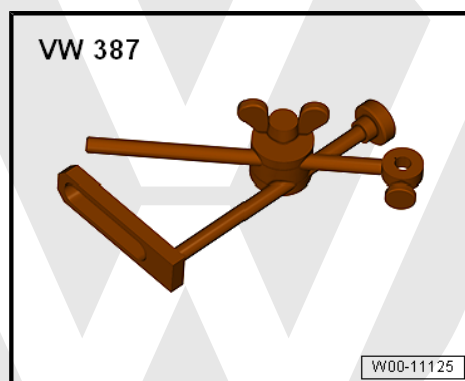




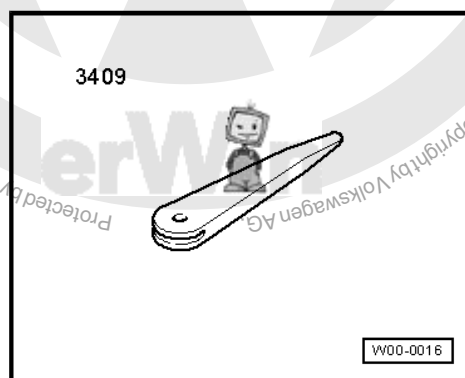
- ◆ Dial Gauge - 0-10mm - VAS6079-



- ◆ Dial Gauge Holder - VW387-



- ◆ Trim Removal Wedge - 3409-



- ◆ Depth Gauge
- ◆ Feeler Gauge



15 – Cylinder Head, Valvetrain

1 Cylinder Head

⇒ [“1.1 Overview - Cylinder Head”, page 79](#)

⇒ [“1.2 Overview - Cylinder Head Cover”, page 81](#)

⇒ [“1.3 Cylinder Head, Removing and Installing”, page 83](#)

⇒ [“1.4 Cylinder Head Cover, Removing and Installing”, page 87](#)

⇒ [“1.5 Vacuum Pump, Removing and Installing”, page 88](#)

⇒ [“1.6 Compression, Checking”, page 90](#)

1.1 Overview - Cylinder Head

1 - Bolt

- 10 Nm

2 - Cylinder Head Cover

- With pressure regulator valve for crankshaft housing ventilation
- Removing and Installing. Refer to
 ⇒ [“1.4 Cylinder Head Cover, Removing and Installing”, page 87](#) .
- Tightening sequence. Refer to
 ⇒ [Fig. “Observe Tightening Sequence for Cylinder Head Cover”](#) ,
 page 81

3 - Cylinder Head Cover Gasket

- Replace if damaged or leaking

4 - Bleeder Hose for Crankcase Ventilation

- To the Intake Manifold

5 - Cap

6 - Seal

- Replace if damaged or leaking

7 - Bolt

- 10 Nm

8 - Wiring Bracket

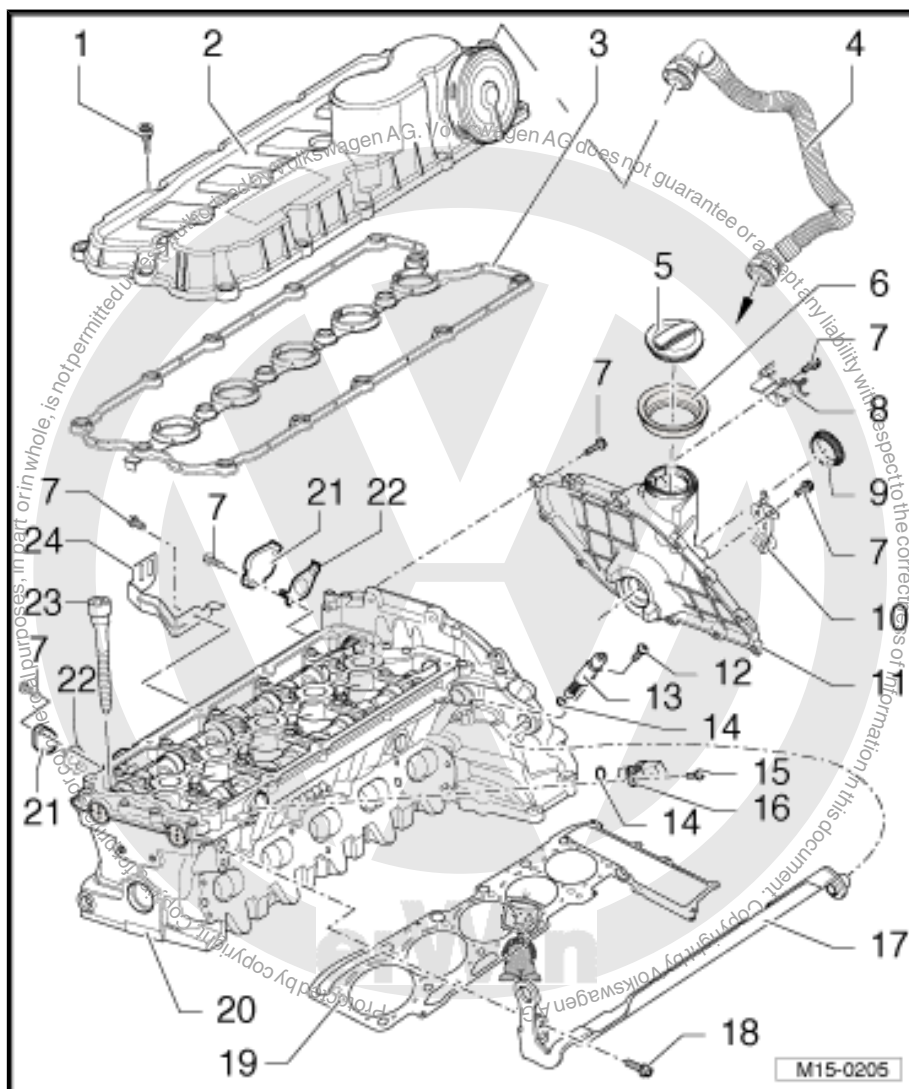
9 - Seal

- Replacing. Refer to ⇒ [“2.2 Timing Chain Cover Seal, Replacing”, page 94](#) .

10 - Wiring Bracket

11 - Timing Chain Cover

- Removing and Installing. Refer to ⇒ [“2.1 Timing Chain Cover, Removing and Installing”, page 92](#) .





12 - Bolt

- ☐ 2 Nm

13 - Camshaft Adjustment Valve 1 - N205-

- ☐ Check with the Vehicle Diagnostic Tester .

14 - O-Ring

- ☐ Replace if damaged
- ☐ No replacement part for the Camshaft Position Sensor - G40- (-item 16- ➔ [Item 16 \(page 80\)](#))

15 - Bolt

- ☐ 10 Nm

16 - Camshaft Position Sensor - G40-

17 - Transport Strap

18 - Bolt

- ☐ 25 Nm

19 - Cylinder Head Seal

- ☐ After replacing, replace the entire amount of coolant
- ☐ Replace after removing or if damaged

20 - Cylinder Head

- ☐ Removing and Installing. Refer to ➔ [“1.3 Cylinder Head, Removing and Installing”, page 83](#) .
- ☐ Checking cylinder head for warpage. Refer to ➔ [Fig. “Checking Cylinder Head for Distortion”, page 81](#)
- ☐ It is not permitted to rework sealing surface
- ☐ with coolant pipe connection pressed in
 - If necessary, remove coolant deposits with a brass wire brush or with a fine sandpaper (minimum 100 grit).
 - If the pipe connection is worn, replace it using Locking Fluid - D 000600 A2- .

21 - Cap

- ☐ Only on engines with the secondary air injection system
- ☐ Engines with the secondary air injection system. Refer to ➔ [“3.1 Overview - Secondary Air Injection System”, page 210](#) .

22 - Seal

- ☐ Replace after removing

23 - Cylinder Head Bolt

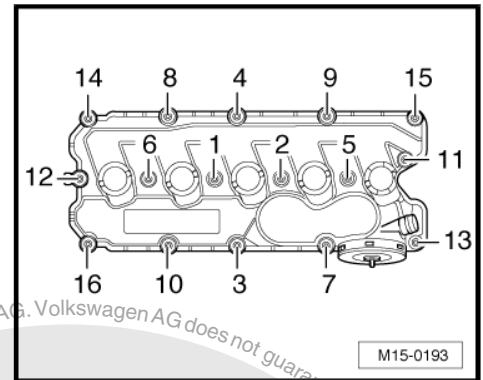
- ☐ Replace after removing
- ☐ Follow the loosening/tightening sequence. Refer to ➔ [“1.3 Cylinder Head, Removing and Installing”, page 83](#)
- ☐ 40 Nm +180°

24 - Wiring Bracket

- ☐ for Heated Oxygen Sensor - G39-



Observe Tightening Sequence for Cylinder Head Cover

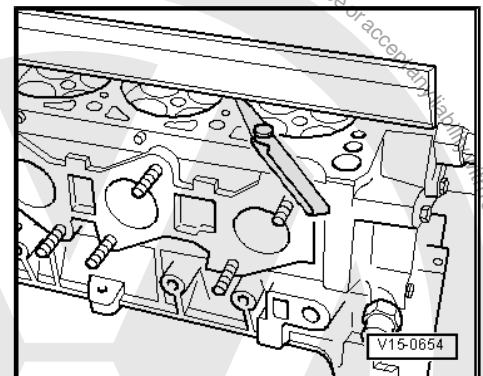


Checking Cylinder Head for Distortion

- Check the cylinder head in several places for distortion using a straight edge and a feeler gauge.

◆ Maximum permissible distortion: 0.05 mm

If this value is exceeded, cylinder head must be replaced. It is not permissible to rework the sealing surface.



1.2 Overview - Cylinder Head Cover



1 - Bolt

- 10 Nm

2 - Cylinder Head Cover

- With pressure regulator valve for crankshaft housing ventilation
- Removing and Installing. Refer to ➤ ["1.4 Cylinder Head Cover, Removing and Installing", page 87](#) .
- Tightening sequence. Refer to ➤ ["Fig. "Observe Tightening Sequence for Cylinder Head Cover"" , page 81](#)

3 - Cylinder Head Cover Gasket

- Replace if damaged or leaking

4 - Bleeder Hose for Crankcase Ventilation

- To the Intake Manifold

5 - Cap

6 - Seal

- Replace if damaged or leaking

7 - Bolt

- 10 Nm

8 - Wiring Bracket

9 - Seal

- Replacing. Refer to ➤ ["2.2 Timing Chain Cover Seal, Replacing", page 94](#) .

10 - Wiring Bracket

11 - Timing Chain Cover

- Removing and Installing. Refer to ➤ ["2.1 Timing Chain Cover, Removing and Installing", page 92](#) .

12 - Bolt

- 2 Nm

13 - Camshaft Adjustment Valve 1 - N205-

- Check with Vehicle Diagnostic Tester .

14 - O-Ring

- No replacement part
- Replace if damaged
- For Camshaft Position Sensor - G40-

15 - Bolt

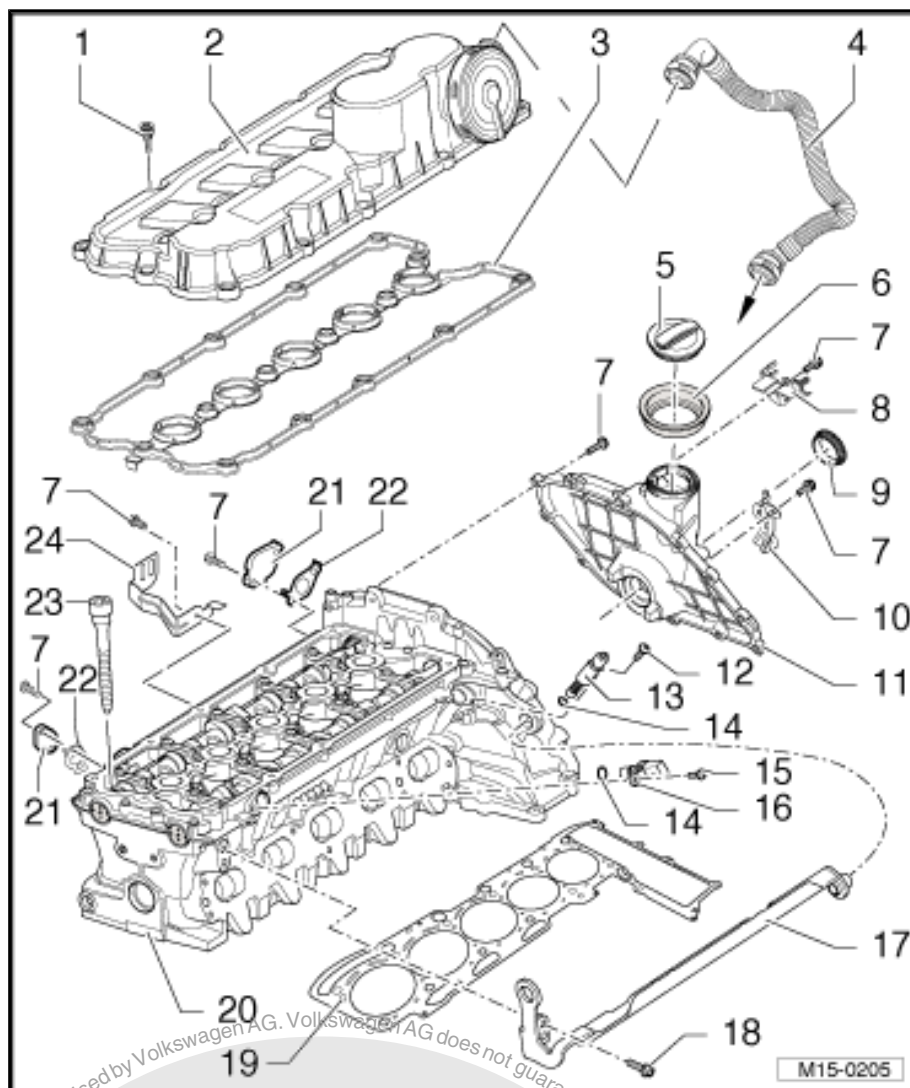
- 10 Nm

16 - Camshaft Position Sensor - G40-

17 - Transport Strap

18 - Bolt

- 25 Nm





19 - Cylinder Head Seal

- ☐ After replacing, replace the entire amount of coolant.
- ☐ Replace after removing or if damaged

20 - Cylinder Head

- ☐ Removing and Installing. Refer to ➤ [“1.3 Cylinder Head, Removing and Installing”, page 83](#) .
- ☐ Checking cylinder head for warpage. Refer to ➤ [Fig. “Checking Cylinder Head for Distortion” , page 81](#)
- ☐ It is not permitted to rework sealing surface
- ☐ With coolant pipe connection pressed in
- If necessary, remove coolant deposits with a brass wire brush or with a fine sandpaper (minimum 100 grit).
- If the pipe connection is worn, replace it using Locking Fluid - D 000600 A2- .

21 - Cap

- ☐ Only on engines with the secondary air injection system
- ☐ Engines with the secondary air injection system. Refer to ➤ [“3.1 Overview - Secondary Air Injection System”, page 210](#) .

22 - Seal

- ☐ Replace

23 - Cylinder Head Bolt

- ☐ Follow the loosening/tightening sequence. Refer to ➤ [“1.3 Cylinder Head, Removing and Installing”, page 83](#)
- ☐ Replace after removing
- ☐ Tightening specification. Refer to -item 23- ➤ [Item 23 \(page 80\)](#) .

24 - Wiring Bracket

- ☐ For Heated Oxygen Sensor - G39-

1.3 Cylinder Head, Removing and Installing



Note

- ◆ *Coat all contact surfaces between the support elements, the roller rocker levers and the lubricating surfaces on the camshaft with oil before installing the “replacement cylinder head”.*
- ◆ *The plastic protectors installed to protect the open valves must only be removed immediately before fitting the cylinder head.*
- ◆ *Replace the cylinder head bolts.*
- ◆ *It is necessary to replace all the engine coolant when the cylinder head or cylinder head gasket are replaced.*

Special tools and workshop equipment required

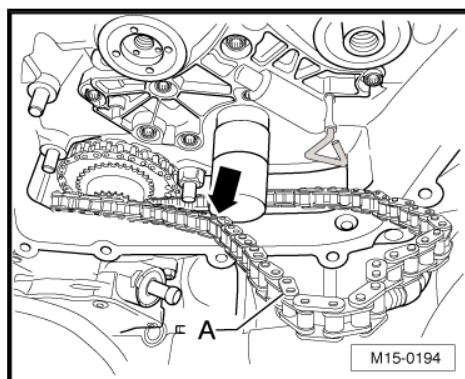
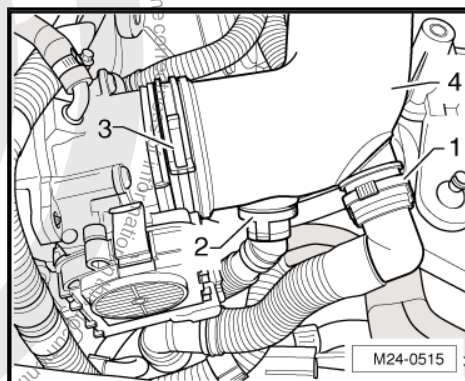
- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Spring Clip Pliers - VAS6499-
- ◆ Polydrive Bit Drive Socket - T10070-
- ◆ Puller - Ignition Coil - T40039-
- ◆ Silicone Sealant - D 174 003 A2-



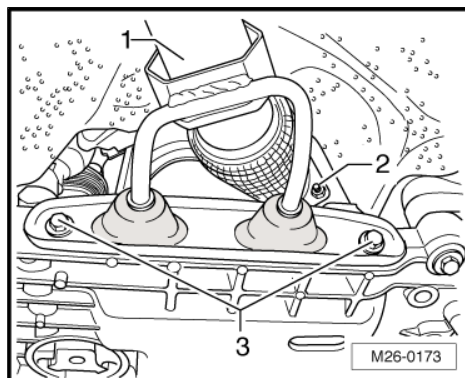


Removing

- Drain the coolant. Refer to
⇒ [“1.4 Coolant, Draining and Filling”, page 147](#) .
- Remove the air filter housing (engine cover). Refer to
⇒ [“3.2 Air Filter Housing, Removing and Installing”, page 186](#) .
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.
- Remove the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- Remove the intake manifold. Refer to
⇒ [“4.3 Intake Manifold, Removing and Installing”, page 189](#) .
- Attach the transport strap to the cylinder head again to hold the cylinder head when removing it.
- Remove the timing chain guard. Refer to
⇒ [“2.1 Timing Chain Cover, Removing and Installing”, page 92](#) .
- Remove the cylinder head cover. Refer to
⇒ [“1.4 Cylinder Head Cover, Removing and Installing”, page 87](#) .
- Secure the camshafts and remove the camshaft chain sprockets. Refer to ⇒ [“3.5 Valve Timing, Adjusting”, page 99](#) .
- Hold the timing chain -A- as illustrated in order to lay it under the pipe connection -arrow-.



- Remove the four nuts -2- and bolts -3-.
- Remove the front exhaust pipe -1- from the exhaust manifold and tie it to the side. Refer to
⇒ [“2.2 Catalytic Converter, Removing and Installing”, page 207](#) .
- Disconnect the connector from the Heated Oxygen Sensor - G39- on the plenum chamber bulkhead.



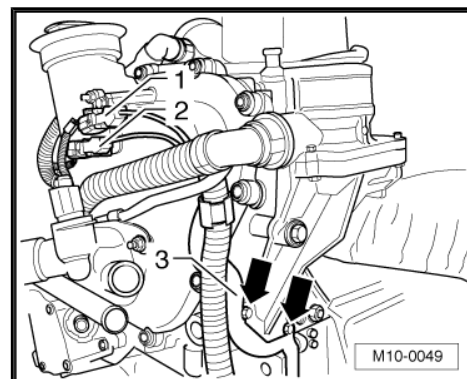


- Remove the cable bracket -3- on the air injection valve or cover (engine without secondary air injection system) -arrows-.
- Remove the cylinder head bolt in the specified sequence.



Note

- ◆ If the bolt -2- was not able to be pulled out using a magnet, loosen bolts of Camshaft Clamp - T40070- one rotation.
- ◆ Slide the Camshaft Clamp - T40070- toward the front at right (seen in direction of travel) and tighten the bolts again.
- ◆ A second technician will be needed to remove and install the cylinder head.



- Carefully remove the cylinder head.

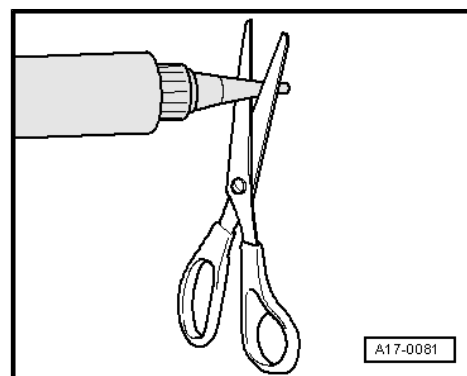
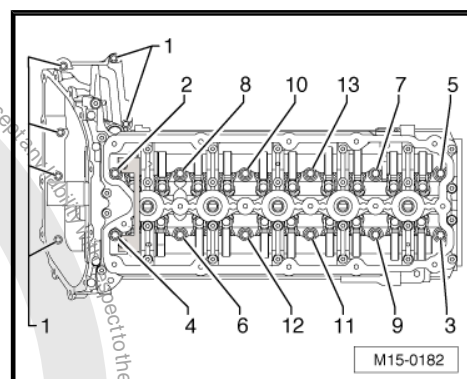
Installing



Note

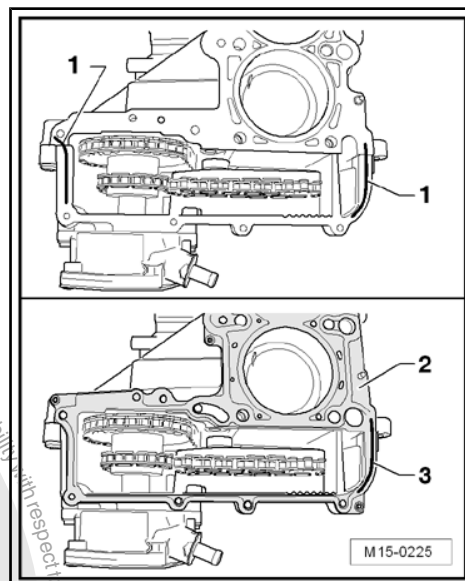
- ◆ There must be no oil or coolant in the blind holes for the cylinder head bolts in the cylinder block.
- ◆ Only unpack the new cylinder head gasket immediately prior to installation.
- ◆ Be very careful when handling the new gasket. Damaging will lead to leaks.
- ◆ Replace the cylinder head bolt.
- Stuff clean cloths into cylinders and chain compartment so that no dirt or abrasive powder can penetrate between cylinder wall and piston and into chain compartment.
- Carefully clean the cylinder head sealing surfaced, control housing cover and cylinder block. Make sure that no long grooves or scratches result (do not use sandpaper with grit below 100).
- Carefully remove metal particles, emery remains and cloths.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 1 mm).

Be sure to check the expiration date of the sealant.





- Apply a bead of sealant -1- (front and rear) on the clean sealing surfaces as illustrated.
- ◆ The sealant bead must be 2.0 to 2.5 mm thick.
- Install the cylinder head gasket -2-.



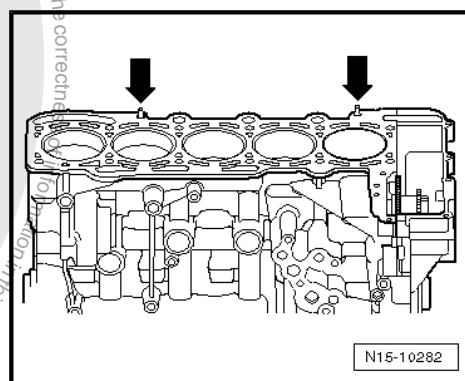
- Pay attention to centering pins in cylinder block -arrows-.



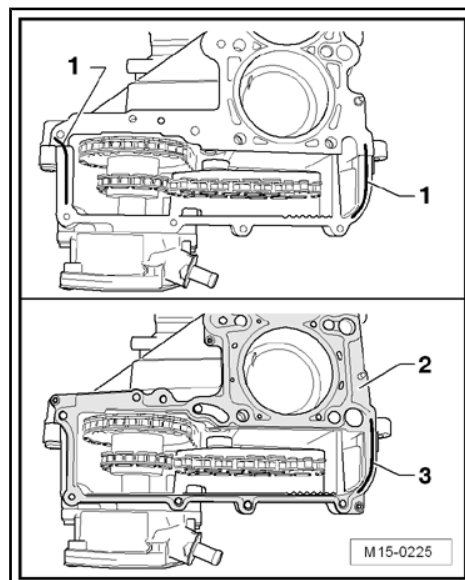
Note

The cylinder head must be installed within 5 minutes of being applied with sealant.

- ◆ The sealant bead must be 2.0 to 2.5 mm thick.



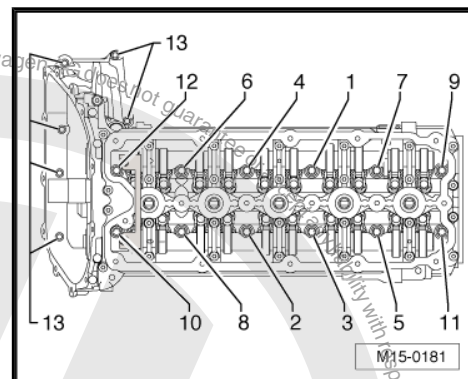
- Apply a bead of sealant -3- (rear only), as illustrated, on the cylinder head seal.
- Install the cylinder head.
- Guide the timing chain over the pipe connection.
- Insert the cylinder head bolts and tighten them hand-tight.





- Then tighten the cylinder head bolts -1- to -12- in the sequence shown as follows:

Step	Bolts	Tightening Specification/ Additional Turn
1.	-1- to -12-	Using torque wrench, tighten to 40 Nm.
2.	-1- to -12-	Tighten an additional 90° using a rigid wrench.
3.	-1- to -12-	Tighten an additional 90° using a rigid wrench.
4.	-13-	Tighten to 10 Nm



- Wipe off any sealant that leaks out.

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt.
- ◆ Install the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- ◆ Drain and fill the coolant. Refer to ⇒ ["1.4 Coolant, Draining and Filling", page 147](#) .

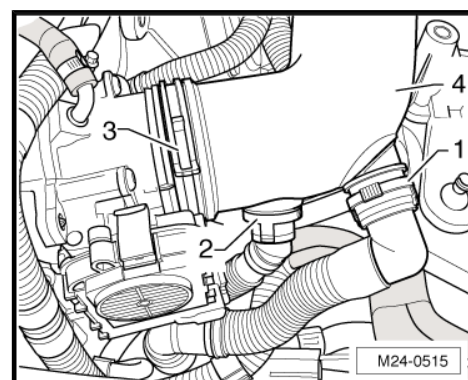
1.4 Cylinder Head Cover, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

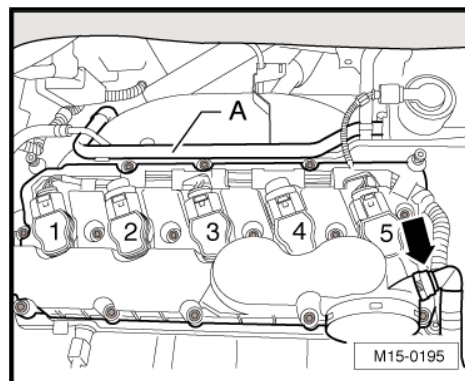
Removing

- Remove the air filter housing (engine cover). Refer to ⇒ ["3.2 Air Filter Housing, Removing and Installing", page 186](#) .
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.





- Remove the air hose -arrow- from the crankcase ventilation.
- Remove the connecting pipe -A-.
- Remove the ignition coils -1 through 5-. Refer to
⇒ [“1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 219](#) .



- Remove the cylinder head cover bolts in the following sequence: -16 to 1-.

Installing

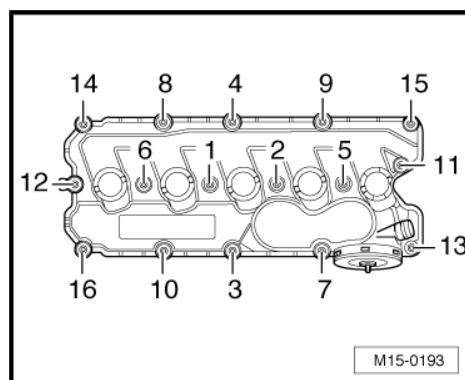
Install in reverse order of removal. Note the following:



Note

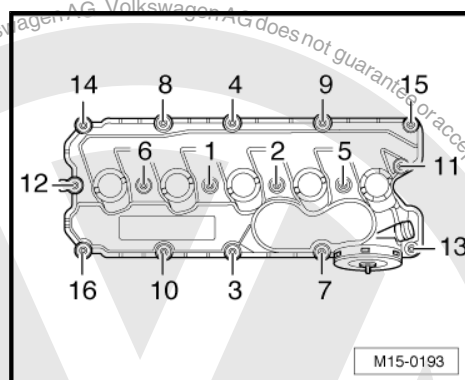
Replace cylinder head cover gasket if damaged or leaking.

- Clean the sealing surfaces: they must be free of oil and grease.
- Tighten the cylinder head cover in the following sequence:
-1 through 16-.



Tightening Specifications

- ♦ Pay attention to the tightening sequence when installing the connecting pipe. Refer to
⇒ [Fig. “Connecting Pipe - Tightening Sequence”](#) ,
[page 211](#) .
- ♦ Refer to ⇒ [“1.2 Overview - Cylinder Head Cover”, page 81](#)
- ♦ Refer to ⇒ [“1.1 Overview - Cylinder Head”, page 79](#)



1.5 Vacuum Pump, Removing and Installing

Special tools and workshop equipment required

- ♦ Torque Wrench 1331 5-50Nm - VAG1331-



Note

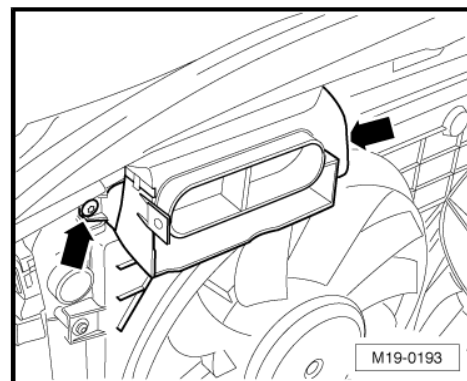
Due to installation conditions, the transmission must be removed on vehicles with automatic transmission.

Removing

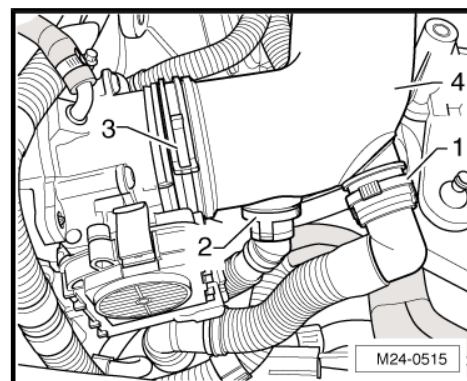
- Remove the air filter housing (engine cover). Refer to
⇒ [“3.2 Air Filter Housing, Removing and Installing”, page 186](#) .
- Remove the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .



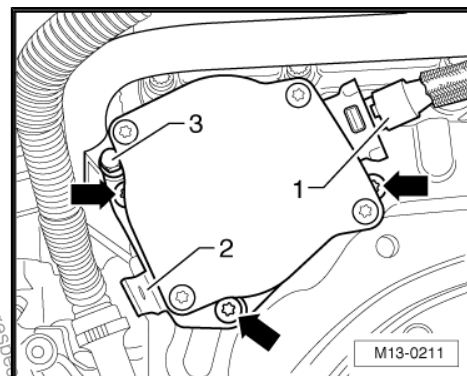
- Remove the intake air scoop from the lock carrier -arrows-.



- Remove the intake hose -4-. Remove the air hoses -1- (if equipped) and -2- (press the locking ring) and the spring clamp -3-.



- Remove the electric wiring harness from the bracket -2-.
- Remove the bolt -3- from the coolant pipe.
- Disconnect the vacuum hose -1-.
- Remove the 3 bolts -arrows- and the vacuum pump.



Note

The 4 cover bolts must not be loosened under any circumstances!

- Remove the old seal.

Installing

- Place the new seal -2- on the vacuum pump.
- Place vacuum pump coupling plate -3- so that it engages into symmetrical groove of double chain sprocket (drive wheel) -1- -arrows- when installing vacuum pump.
- Tighten the bolts.

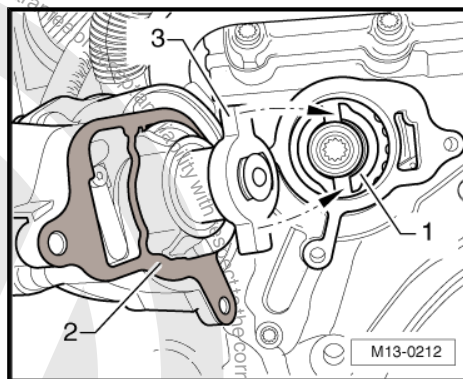
The rest of the installation follows the reverse of the removal procedures.



- Install the battery. Refer to ➔ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .

Tightening Specifications

Component	Nm
Vacuum pump to control housing cover	10
Coolant pipe to bracket	10



1.6 Compression, Checking

Special tools and workshop equipment required

- ◆ Spark Plug Removal Tool - 3122B-
- ◆ Compression Tester Kit - VAG1763-
- ◆ Fuel Injection Gauge Kit - Adapter VAG1381/1 - VAG1381/1-
- ◆ Compression Tester Kit - Adapter 5A - VAG1381/5A-

Test Conditions:

- Engine oil temperature must be at least 30 °C (86 °F).
- Voltage supply OK.
- Remove the air filter housing (engine cover). Refer to ➔ [“3.2 Air Filter Housing, Removing and Installing”, page 186](#) .
- Remove the connector from all fuel injectors.
- Remove the ignition coils with the power output stages. Refer to ➔ [“1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 219](#) .
- Remove the spark plugs using Spark Plug Removal Tool - 3122B- .
- Check the compression pressure using the Compression Tester Kit - VAG1763- and Compression Tester Kit - Adapter 5A - VAG1381/5A- .



Note

Refer to the Operating Instructions for information on using the tester.

- Have a second technician operate the starter.
- Operate the starter until tester shows no further pressure increase.

Compression Values:

New Positive Pressure	Wear Limit Positive Pressure	Difference Between Cylinders Positive Pressure
9.0 to 13.0 bar (130 to 188.5 psi)	8.0 bar (116 psi)	maximum 3.0 bar (43.5 psi)



- Erase the faults in the engine control module DTC memory that were stored when the connector was disconnected using the Vehicle Diagnostic Tester .





2 Timing Chain Cover

⇒ [“2.1 Timing Chain Cover, Removing and Installing”, page 92](#)

⇒ [“2.2 Timing Chain Cover Seal, Replacing”, page 94](#)

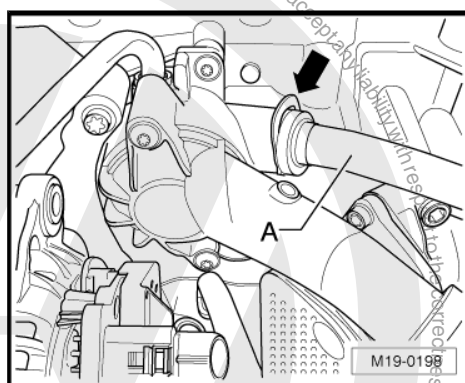
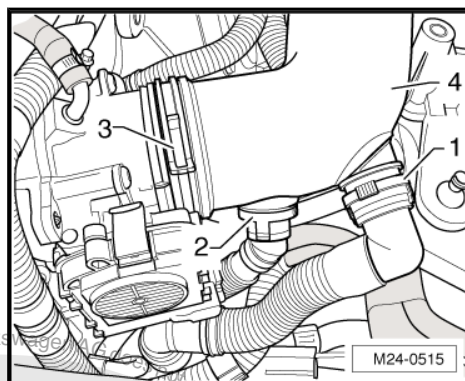
2.1 Timing Chain Cover, Removing and Installing

Special tools and workshop equipment required

- ◆ Pry Lever - 80-200-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Silicone Sealant - D 174 003 A2-

Removing

- Remove the air filter housing (engine cover). Refer to ⇒ [“3.2 Air Filter Housing, Removing and Installing”, page 186](#).
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.
- Remove the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- Drain the coolant. Refer to ⇒ [“1.4 Coolant, Draining and Filling”, page 147](#) .
- Remove the intake manifold. Refer to ⇒ [“4.3 Intake Manifold, Removing and Installing”, page 189](#).
- Remove the coolant pipe at the coolant distribution housing and the bracket on the vacuum pump.
- Remove the clamp -arrow- and the coolant pipe -A-.
- Disconnect the connectors -1- and -3-.
- Remove the pressure pipe -2- from the secondary air injection solenoid valve.
- Remove the rear coolant pipe -4-.
- Remove the vacuum hose -6- from the vacuum pump and the connector -7-.
- Remove the bracket -8- and -9- and then move the electric wiring harness and pressure pipe to the side.
- Push the wiring harness knock sensor bracket on the secondary air injection solenoid valve slightly to the rear.





- Disconnect the coolant distribution housing -5- and move it to the side with the coolant hoses still connected.

i Note

- ♦ *Sealing surfaces must not be damaged under any circumstances. Use the Trim Removal Wedge - 3409- .*
- ♦ *Clean the Trim Removal Wedge - 3409- after removing the timing chain cover because it is meant to be used for removing parts from the interior of the vehicle.*

- Remove the bolts from the timing chain cover.
- Remove the timing chain cover -1- from the cylinder head at the upper and lower holes -2-.

Installing



WARNING

To prevent injuries from shavings, wear protective goggles and protective clothing.

- Remove any remaining sealing compound from the timing chain cover and cylinder head with a plastic bush.



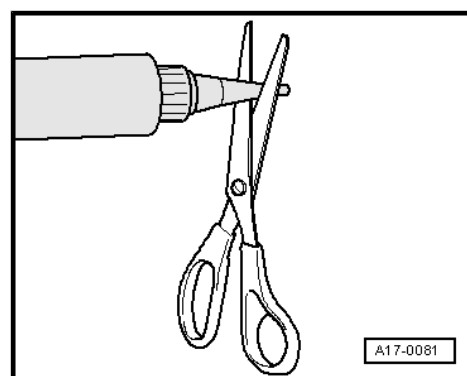
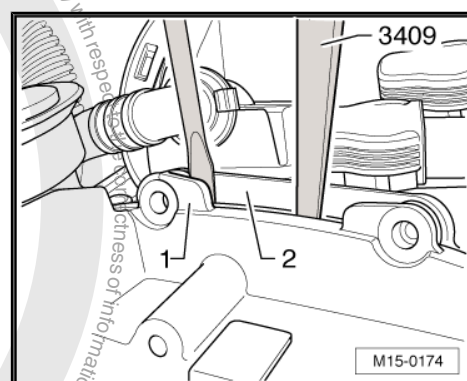
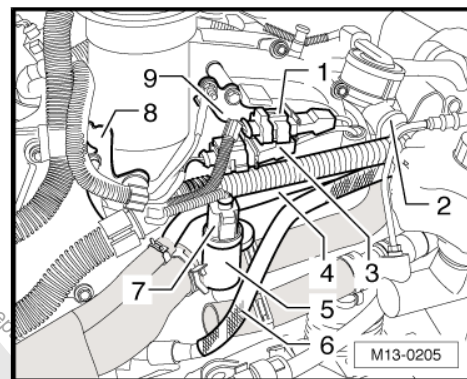
Caution

Make sure that no sealant residue gets into the engine.

- Clean the pipe connection on the cylinder head. If necessary, remove coolant deposits with a brass wire brush or with a fine sandpaper (minimum 100 grit). If the pipe connection is worn, replace it using Locking Fluid - D 000600 A2- .
- Replace the seal in the timing chain cover. Refer to [⇒ "2.2 Timing Chain Cover Seal, Replacing", page 94](#) .
- Clean the sealing surfaces: they must be free of oil and grease.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 1 mm).

i Note

Timing chain cover must be installed within 5 minutes of applying sealant.





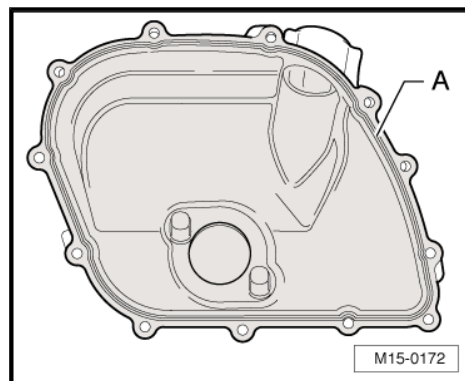
- Apply sealant bead -A- onto the clean sealing surface of the timing chain cover as shown.
- ♦ The sealant bead must be 1.5 to 2.0 mm thick.
- Coat the seal for the timing chain cover lightly with engine oil and push the timing chain cover onto the pipe connections.
- Install and tighten the all the bolts diagonally.

The rest of the installation follows the reverse of the removal procedures. Note the following:

- Fill the coolant. Refer to
⇒ ["1.4 Coolant, Draining and Filling", page 147](#) .
- Install the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .

Tightening Specifications

Component	Nm
Timing chain cover to cylinder head	10
Coolant distribution housing to timing chain cover	10



2.2 Timing Chain Cover Seal, Replacing

Conditions

- The timing chain cover is removed.

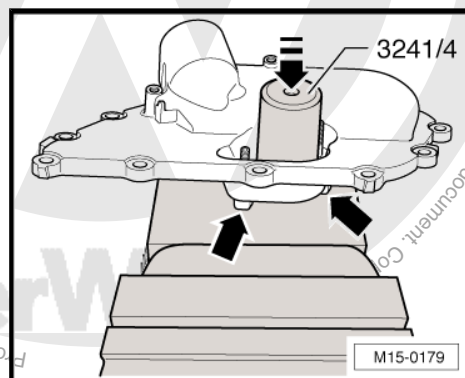
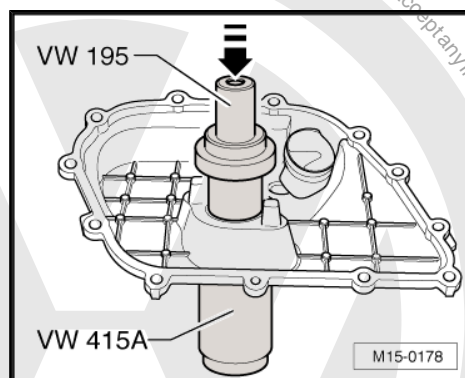
Special tools and workshop equipment required

- ♦ Seal Installer - Drive Axle - VW195-
- ♦ Press Piece - 60mm - VW415A-
- ♦ Seal Installer - Camshaft Installer Kit - Sleeve - 3241/4-

Removing the Seal

Installing the Seal

- Support the timing chain guard with the connections -arrows- on a secure backing and press in the new seal up to the stop.





3 Chain Drive

- ⇒ [“3.1 Overview - Camshaft Timing Chains”, page 95](#)
- ⇒ [“3.2 Timing Chain Assembly Overview”, page 96](#)
- ⇒ [“3.3 Overview - Timing Mechanism Drive Chain”, page 97](#)
- ⇒ [“3.4 Valve Timing, Checking”, page 98](#)
- ⇒ [“3.5 Valve Timing, Adjusting”, page 99](#)

3.1 Overview - Camshaft Timing Chains

1 - Camshaft Adjuster for Intake Camshaft

- ☐ With chain sprocket
- ☐ Do not disassemble

2 - Chain Sprocket for Exhaust Camshaft

- ☒ Not pressed on the camshaft
- ☐ When removing, press off lightly if necessary

3 - Cylinder Head

4 - Tensioning Rail

- ☐ For timing chain tensioner
- ☐ Secured on cylinder block
- ☐ Oil pin before installing

5 - Double Chain Sprocket (Drive Wheel)

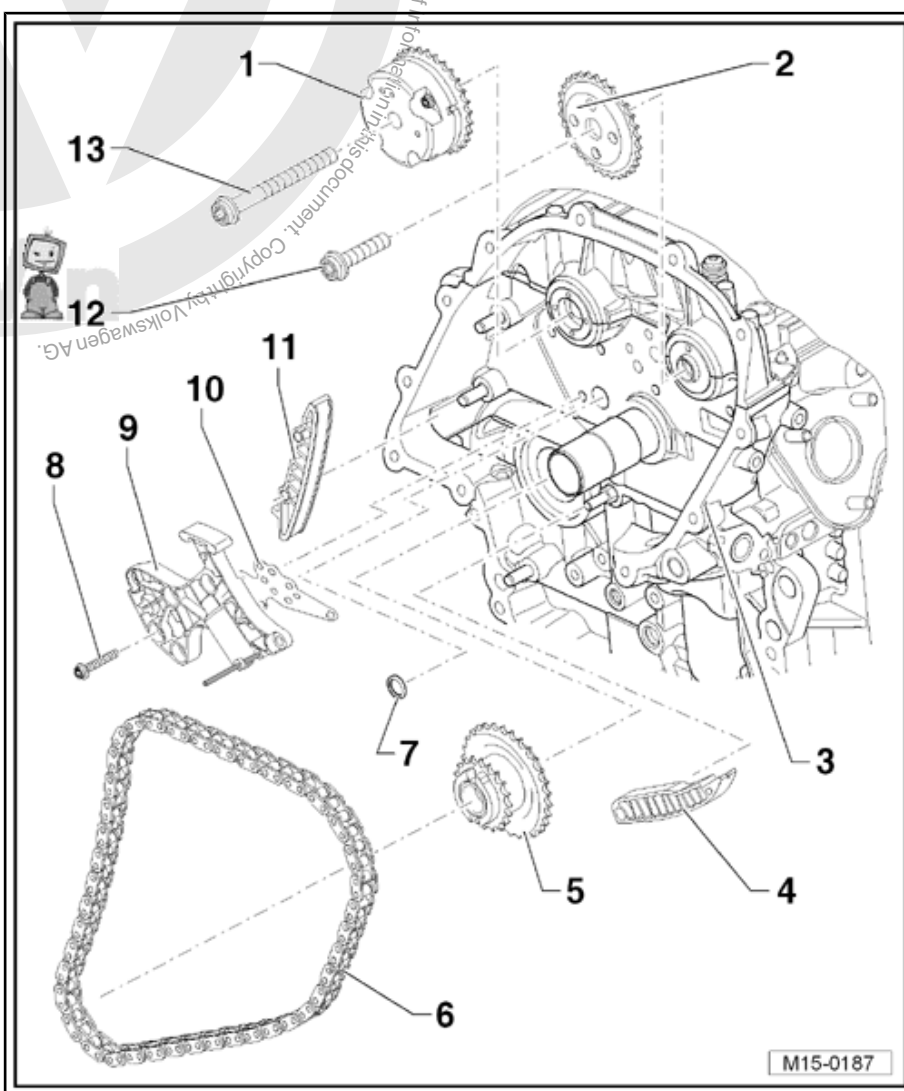
- ☐ Securing -item 11-
⇒ [Item 11 \(page 98\)](#)

6 - Timing Chain

- ☐ Removing:
 - Work procedure as for “Adjust valve timing”. Refer to
⇒ [“3.5 Valve Timing, Adjusting”, page 99](#) .
 - Remove the vacuum pump. Refer to
⇒ [“1.5 Vacuum Pump, Removing and Installing”, page 88](#) .
- Mark the direction of travel.
- ☐ Note when installing:
 - Install in original direction of rotation.
 - Chain must lie correctly in tensioning and glide tracks.
 - Adjust the valve timing. Refer to ⇒ [“3.5 Valve Timing, Adjusting”, page 99](#) .

7 - Strainer

- ☐ Replace





8 - Bolt

- ☐ 10 Nm

9 - Chain Tensioner

- ☐ Secure with Locking Pins - T03006-

10 - Seal

- ☐ Replace after removing

11 - Guide Rail

- ☐ Oil pin before installing

12 - Bolt

- ☐ 60 Nm +90°
- ☐ Replace after removing

13 - Bolt

- ☐ 60 Nm +90°
- ☐ Replace after removing

3.2 Timing Chain Assembly Overview

1 - Chain Sprocket for Exhaust Camshaft

2 - Chain tensioner for Timing Chain

- ☐ At top with sliding insert

3 - Timing Chain

4 - Tensioning Rail

- ☐ For timing chain tensioner
- ☐ Secured on cylinder block

5 - Chain Tensioner for Drive Chain

- ☐ With tensioning track

6 - Chain Sprocket of Crankshaft

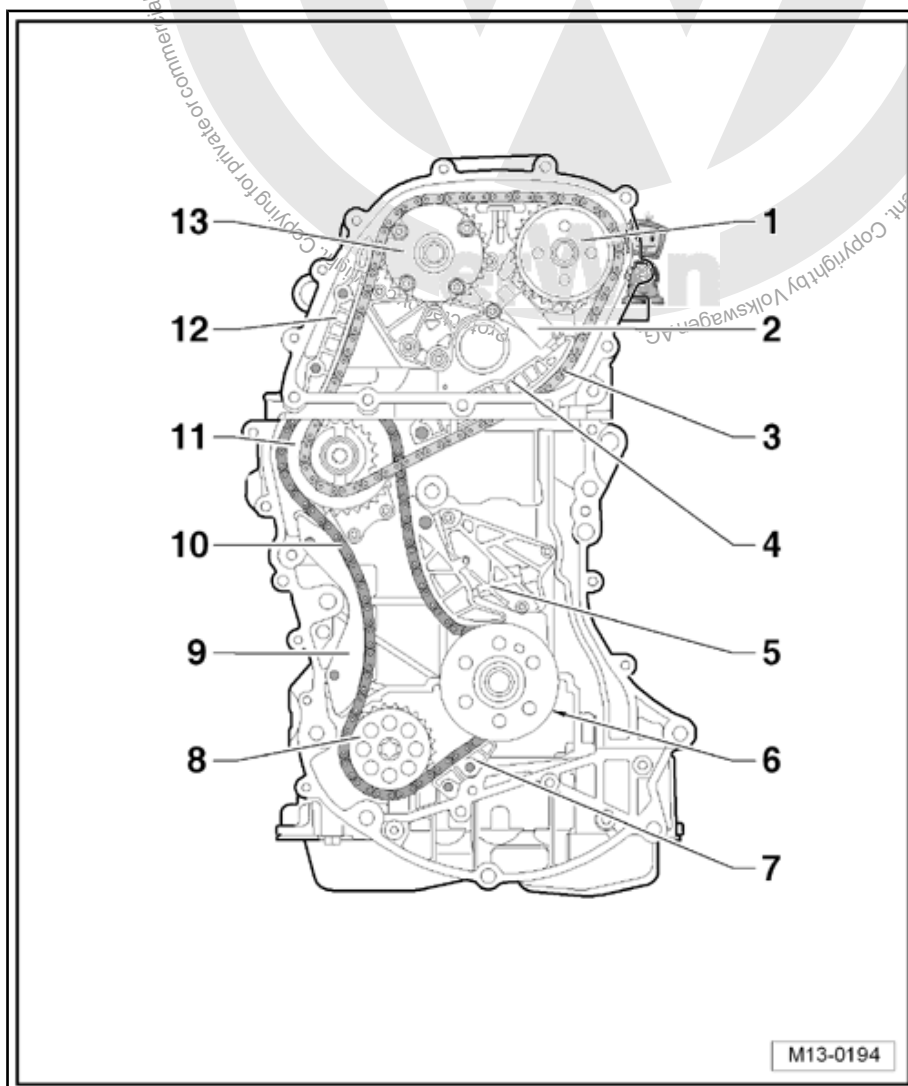
- ☐ Component of crankshaft

7 - Guide Rail for Drive Chain

- ☐ Secured on the oil pan upper section

8 - Chain Sprocket of Oil Pump

- ☐ Removing and Installing. Refer to ["1.5 Oil Pump, Removing and Installing", page 129](#).





- 9 - Guide Rail for Drive Chain
- 10 - Power Take-Off Drive Chain
- 11 - Double Chain Sprocket (Drive Wheel)
- 12 - Glide Track for Timing Chain
- 13 - Camshaft Adjuster for Intake Camshaft
 - ☐ With chain sprocket

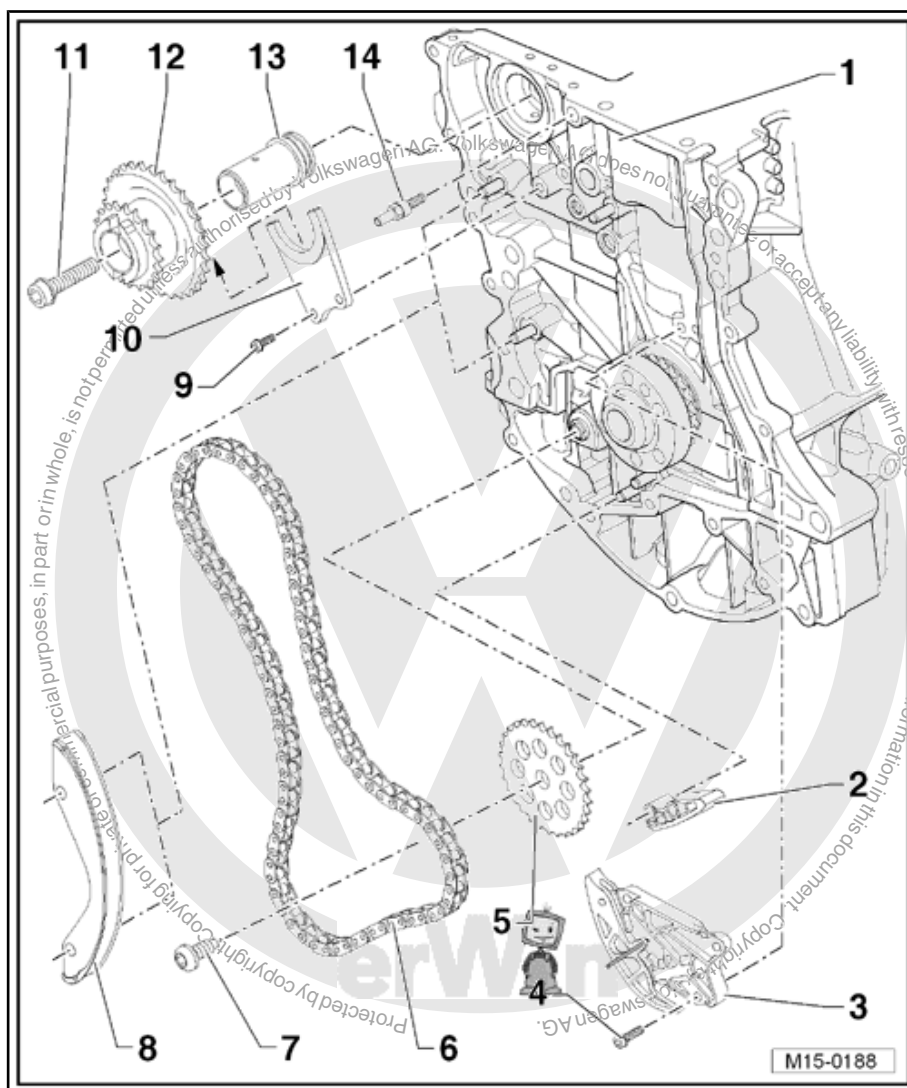
3.3 Overview - Timing Mechanism Drive Chain

- 1 - Cylinder Block
- 2 - Guide Rail for Drive Chain
 - ☐ Secured on the oil pan upper section
 - ☐ Oil pin before installing
- 3 - Chain Tensioner for Drive Chain
 - ☐ Secure with Locking Pin - T10115-
- 4 - Bolt
 - ☐ 10 Nm
- 5 - Chain Sprocket of Oil Pump
 - ☐ Removing and Installing. Refer to
[⇒ "1.5 Oil Pump, Removing and Installing", page 129](#) .

- 6 - Power Take-Off Drive Chain
 - ☐ Removing:
 - Remove the engine.
 - Remove control housing cover.
 - Remove timing chain.
 - Remove chain tensioner -item 3-
[⇒ Item 3 \(page 97\)](#) .
 - Mark the direction of travel.

- ☐ Note when installing:
 - Install in original direction of rotation.
 - Chain must lie correctly in tensioning and glide tracks.
 - Adjust the valve timing. Refer to [⇒ "3.5 Valve Timing, Adjusting", page 99](#) .

- 7 - Bolt
 - ☐ 20 Nm +90°
 - ☐ Replace





8 - Guide Rail for Drive Chain

- ☐ Oil pin before installing

9 - Bolt

- ☐ 10 Nm

10 - Axial Bearing Disc

- ☐ Engages in groove of double chain sprocket (drive wheel) -item 12- ➔ [Item 12 \(page 98\)](#) .

11 - Bolt

- ☐ 60 Nm +90°
- ☐ Replace

12 - Double Chain Sprocket (Drive Wheel)

- ☐ Oil the journal before installing
- ☐ Lubricate the axial bearing shell groove -item 10- ➔ [Item 10 \(page 98\)](#)

13 - Journal for Double Chain Sprocket (Drive Wheel)

14 - Tensioning Rail Pins

- ☐ 40 Nm
- ☐ For timing chain tensioner

3.4 Valve Timing, Checking

Special tools and workshop equipment required

- ◆ Camshaft Clamp - T40070-

Procedure

- Remove the cylinder head cover. Refer to ➔ ["1.4 Cylinder Head Cover, Removing and Installing", page 87](#) .
- Lock the crankshaft in place for checking the valve timing. Refer to ➔ ["3.2 Crankshaft, Locking", page 64](#) .

Valve Timing is Correct

Valve timing is correct when the Camshaft Clamp - T40070- bolts can be screwed in easily to the end into camshafts as shown. The Camshaft Clamp - T40070- support surfaces must lie flat on flat area of camshaft when doing this.

- If the bolts are difficult to install, position an 18 mm or 19 mm open end wrench -A- at the opening on the exhaust camshaft and rotate the camshaft slightly in the direction of -arrow- to remove any play in the chain drive.



If the Camshaft Clamp - T40070- bolt can now be screwed in easily with chain drive tensioned in this manner, valve timing is also correct. Possibly the crankshaft was not secured correctly.

Valve Timing is Not Correct.

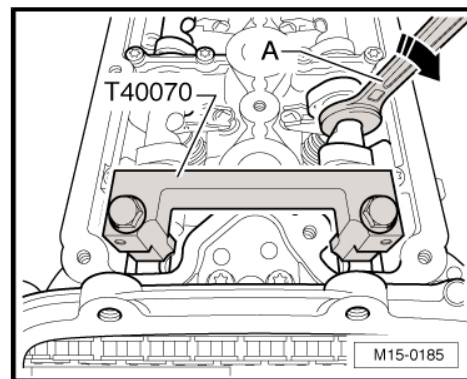
Valve timing is not correct when bolts of Camshaft Clamp - T40070- cannot be screwed in easily to the end into camshafts despite the tensioned chain drive.

- ◆ In this case it is necessary to adjust the valve timing. Refer to ⇒ ["3.5 Valve Timing, Adjusting", page 99](#) .

Assembly

Assembly is performed in the reverse order of removal. Note the following:

- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt. Refer to ⇒ ["1.3 Knock Sensor 1 G61 , Removing and Installing", page 220](#) .



3.5 Valve Timing, Adjusting

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Locking Pins - T03006-
- ◆ Multipoint Socket - T10035-
- ◆ Counterhold - Kit - Multiple Use - T10172-
- ◆ Camshaft Clamp - T40070-
- ◆ Two M8 x 16 bolts

Convert the Counterhold - Multiple Use T10172A-

- Remove the Counterhold - Kit - Multiple Use Adapter - T10172/1- and the M 8x19 bolts -A-.

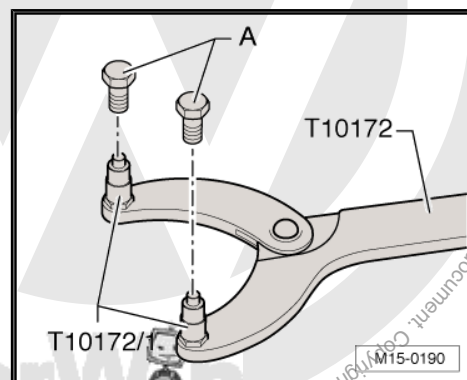


Note

The valve timing must be adjusted if the camshaft chain sprockets were loosened during repairs or if the valve timing is not set.

Securing Camshafts if the Valve Timing is Correct:

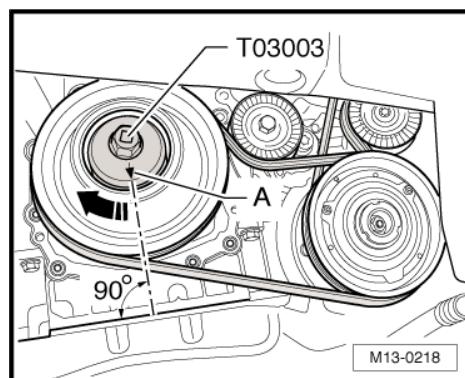
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the right front wheel housing liner. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Wheel Housing Liner; Overview - Front Wheel Housing Liner .





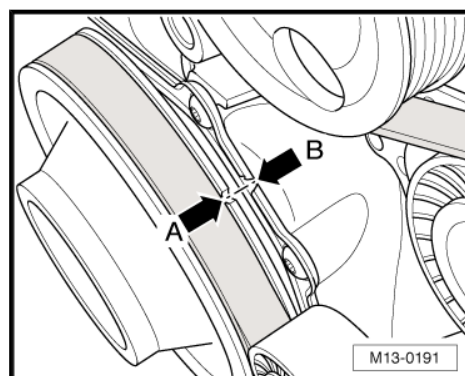
- Attach the Crankshaft Adapter - T03003- on to belt pulley bolts.
- The Crankshaft Adapter - T03003- can only be inserted correctly in one position.
- Rotate the crankshaft in direction of engine rotation in direction of -arrow- far enough until arrow -A- on Crankshaft Adapter - T03003- points downward vertically, relative to the engine axis.

This position corresponds approximately to TDC position of crankshaft at cylinder 5.

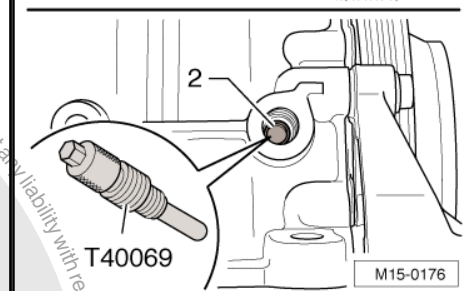
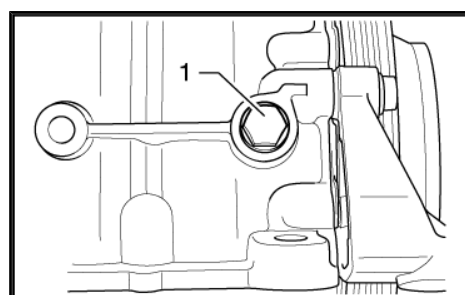


Note

With engine removed, TDC marking can also be seen on belt pulley and sealing flange on belt pulley side. Notches -A- and -B- must align.



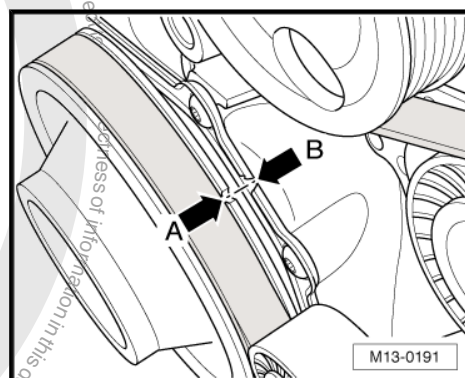
- Remove the sealing plug -1- on the back of the cylinder block.
- Look through the threaded hole. Make sure the hole -2- in the crankshaft is lined up with the threaded hole.
- Use a mirror for this.
- Turn the crankshaft slightly, if necessary.
- When the holes line up, install the Crankshaft Locking Pin - T40069- all the way into the threaded hole and tighten it to 10 Nm.



Note

With engine removed, TDC marking can also be seen on belt pulley and sealing flange on belt pulley side. Notches -A- and -B- must align.

- Make sure the crankshaft cannot be turned.
- Remove the timing chain cover. Refer to ➔ [“2.1 Timing Chain Cover, Removing and Installing”, page 92](#).
- Remove the cylinder head cover. Refer to ➔ [“1.4 Cylinder Head Cover, Removing and Installing”, page 87](#).





Note

If threaded holes in camshafts -arrows- do not stand upward, crankshaft must be rotated one rotation (360°) in direction of engine rotation.

In Order to Be Able to Precisely Check and Adjust Valve Timing, Always Note the Following:

- ◆ Only turn crankshaft only in direction of engine rotation -arrow-. Do not rotate crankshaft back, not even slightly!
- ◆ Crankshaft must not be rotated out over the TDC marking. This means bore -2- in crankshaft must not stand above threaded opening.

If crankshaft was rotated out over the TDC marking:

- Turn the crankshaft back 45° opposite the direction of engine rotation.

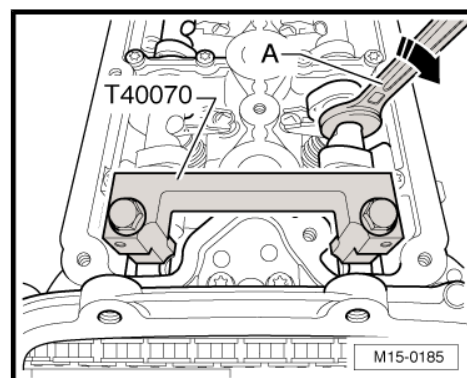
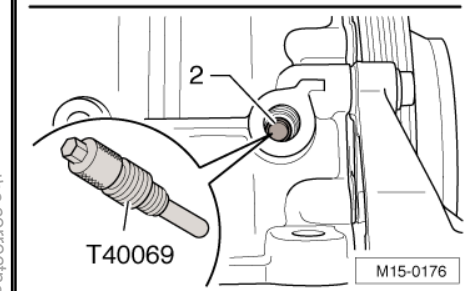
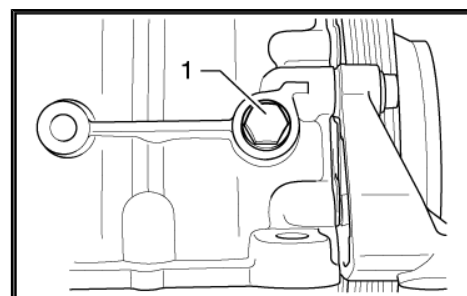
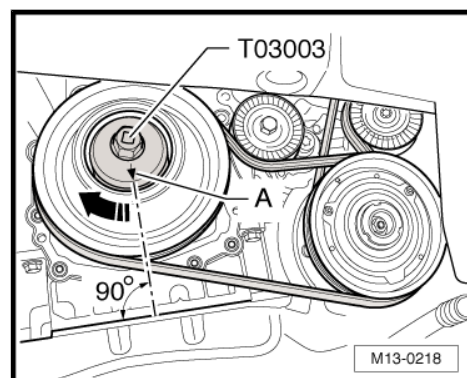
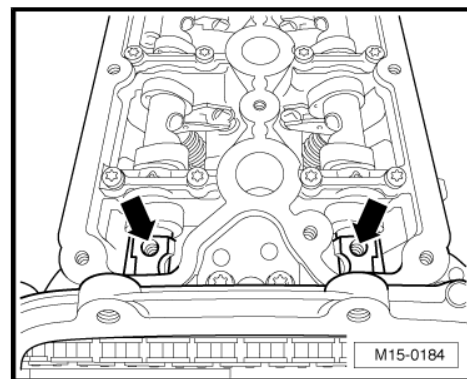
- Turn the crankshaft again in direction of engine rotation to TDC.

When the crankshaft is positioned slightly in front of the TDC position (hole in crankshaft is 90 % visible), the Crankshaft Locking Pin - T40069- can be screwed in, although slightly more difficult.

- Lock the crankshaft in place to adjust the valve timing. Refer to ⇒ **"3.2 Crankshaft, Locking", page 64** .

- Attach the Camshaft Clamp - T40070- to the camshafts as illustrated and tighten the bolts to 20 Nm.

If the bolts are difficult to install, position an 18 mm or 19 mm open end wrench -A- at the opening on the exhaust camshaft and rotate the camshaft slightly in the direction of -arrow- to remove any play in the chain drive.





- Release the timing chain tension. To do this, insert an appropriate screwdriver between the piston of the chain tensioner and the tensioning rail and press in direction of -arrow-.
- Secure the fully pushed-in piston with Locking Pins - T03006- . The locking pin must be inserted all the way.

Securing Camshafts if the Valve Timing is Not Correct.

- Remove the timing chain cover. Refer to ➔ ["2.1 Timing Chain Cover, Removing and Installing", page 92](#) .
- Turn the crankshaft to cylinder 5 TDC. (Refer to ➔ ["3.4 Valve Timing, Checking", page 98](#)) but do not remove the crankshaft with Crankshaft Locking Pin - T40069- .
- Turn the crankshaft so the Camshaft Clamp - T40070- can be attached easily to the camshafts, as illustrated.
- Tighten the bolts on the Camshaft Clamp - T40070- to 20 Nm.

Removing the Camshaft Chain Sprocket.

- Release the tension on the timing chain. To do this, insert an appropriate screwdriver between the piston of the chain tensioner and the tensioning rail and press in direction of -arrow-.
 - Secure the fully pushed-in piston with Locking Pins - T03006- . The locking pin must be inserted all the way.
 - Remove the bolts -1- and -4- with the Multipoint Socket - T10035- and remove the chain sprockets -2- and -3-.
- If necessary, chain sprocket -3- must be pressed off lightly using a screwdriver.

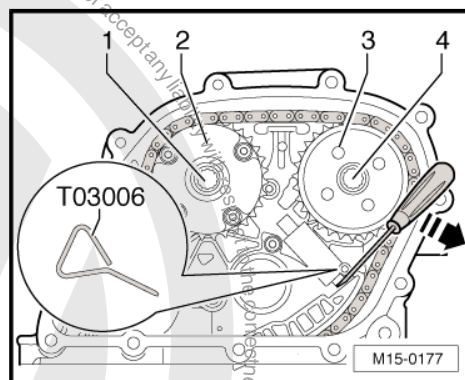
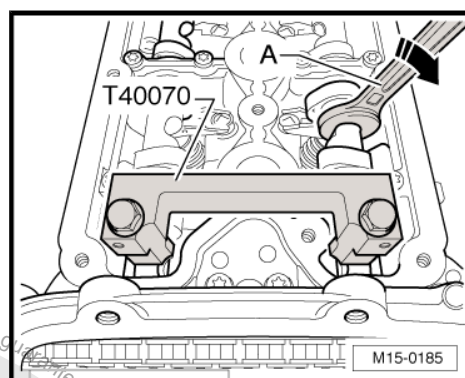
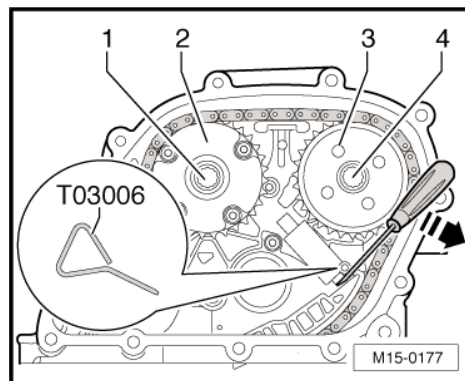


Note

Secure the crankshaft (Refer to ➔ ["3.2 Crankshaft, Locking", page 64](#)) if it still not secured. Crankshaft must only be rotated slightly around TDC point for this. Otherwise there is a risk the valves rest on the pistons.

Valve Timing, Adjusting

- Lock the crankshaft with the Crankshaft Locking Pin - T40069- .
- Secure the camshaft using the Camshaft Clamp - T40070- .
- Chain tensioner is tensioned



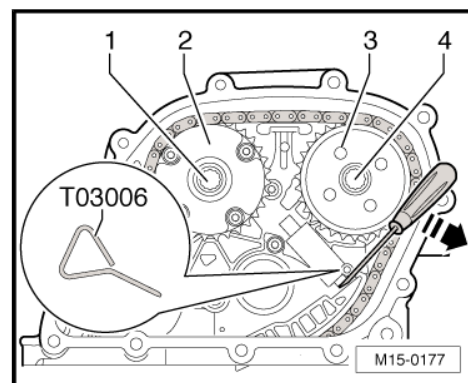


- Place the chain sprockets -2- and -3- in the timing chain as illustrated and then mount them on the camshafts. Install the new bolts -1- and -4- hand-tight.

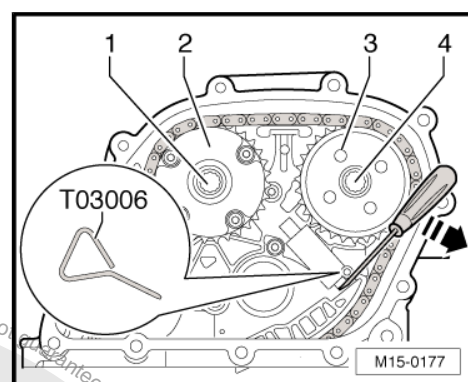
Chain gears must still be able to be rotated, however they must not tilt.

i Note

Make sure that timing chain lies correctly in gliding and tensioning tracks.



- Push in the plunger in the chain tensioner, remove Locking Pins - T03006- and release the tension on the chain tensioner.



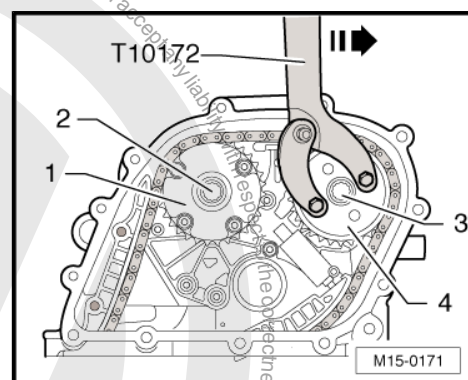
- Mount the Counterhold - Kit - Multiple Use - T10172A- on the exhaust camshaft chain sprocket -4-.

i Note

A second technician will be needed for the rest of the procedure.

- Push the Counterhold - Kit - Multiple Use - T10172A- in the direction of the arrow- to hold timing chain at pre-load.
- Tighten the intake camshaft bolt -2- first and then the exhaust camshaft bolt -3- to 60 Nm.

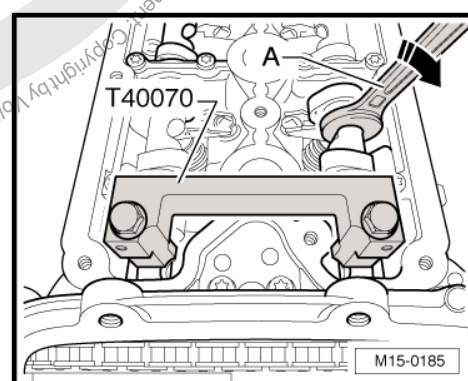
Then tighten bolts -2- and -3- a 90° additional turn.



i Note

When applying the additional torque of 90°, timing chain must no longer be held at pre-load.

- Remove the Camshaft Clamp - T40070- .





- Remove the Crankshaft Locking Pin - T40069- for securing the crankshaft.
- Turn the crankshaft 2 turns in direction of engine rotation and lock it into place. Refer to
⇒ ["3.2 Crankshaft, Locking", page 64](#) . The crankshaft is locked to check/adjust the valve timing.

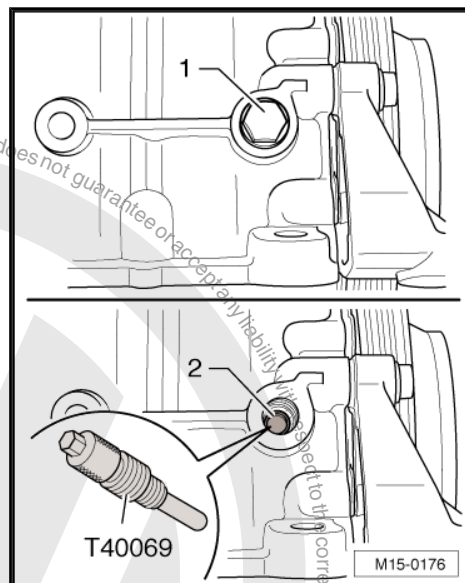
- Valve Timing, Checking. Refer to
⇒ ["3.4 Valve Timing, Checking", page 98](#) .

If valve timing is not correct:

- Loosen the camshaft chain sprocket again and adjust the valve timing again (replace the camshaft bolts).

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt.
- ◆ Fill the coolant. Refer to
⇒ ["1.4 Coolant, Draining and Filling", page 147](#) .





4 Valvetrain

⇒ [“4.1 Overview - Valvetrain”, page 105](#)

⇒ [“4.2 Camshaft, Removing and Installing”, page 107](#)

⇒ [“4.3 Valve Stem Seals, Removing and Installing”, page 111](#)

⇒ [“5 Intake and Exhaust Valves”, page 115](#)

4.1 Overview - Valvetrain



Note

- ◆ *Cylinder heads with cracks between the valve seats, or between the valve seat and the spark plug threads, can continue to be used without reducing the service life, as long as the cracks have a width of max. 0.3 mm, or only the first 4 threads of the spark plug threads are cracked.*
- ◆ *The cylinder head and guide frame must be replaced together.*
- ◆ *Do not mill the valve seats in the cylinder head. Only grinding the valves is permitted.*
- ◆ *Do not start the engine for approximately 30 minutes after installing the camshafts. The hydraulic adjusters must seat themselves (otherwise the valves will crash into the pistons).*
- ◆ *After working on the valvetrain and lifters, carefully rotate the crankshaft by hand at least 2 full revolutions before starting to be sure that valves do not strike the pistons.*
- ◆ *Replace the gaskets and seals.*



1 - Bolt

- ☐ 8 Nm +90°
- ☐ Replace after removing
- ☐ Refer to
⇒ [Fig. "Tightening Sequence/Torque", page 107](#)

2 - Guide Frame

- ☐ Removing and Installing. Refer to
⇒ ["4.2 Camshaft, Removing and Installing", page 107](#).
- ☐ With integrated camshaft bearings
- ☐ Clean sealing surface, reworking is not permitted.
- ☐ Remove old sealant residue.

3 - Chain Sprocket

- ☐ For the exhaust camshaft

4 - Bolt

- ☐ 60 Nm +90°
- ☐ Replace after removing

5 - Bolt

- ☐ 60 Nm +90°
- ☐ Replace after removing

6 - Camshaft Adjuster

- ☐ For the intake camshaft

7 - Seals

- ☐ For camshaft adjuster
- ☐ Note the installation position. Refer to ⇒ ["4.2 Camshaft, Removing and Installing", page 107](#).

8 - Timing Chain

- ☐ Remove from the chain sprocket. Refer to ⇒ ["3.5 Valve Timing, Adjusting", page 99](#)

9 - Cylinder Head

- ☐ Do not re-grind valve seats, only hand-lapping is permitted.

10 - Hydraulic Adjusting Element

- ☐ Do not interchange
- ☐ Lubricate contact surface

11 - Valve Retainers

12 - Upper Valve Spring Retainer

13 - Valve Spring

14 - Valve Stem Seal

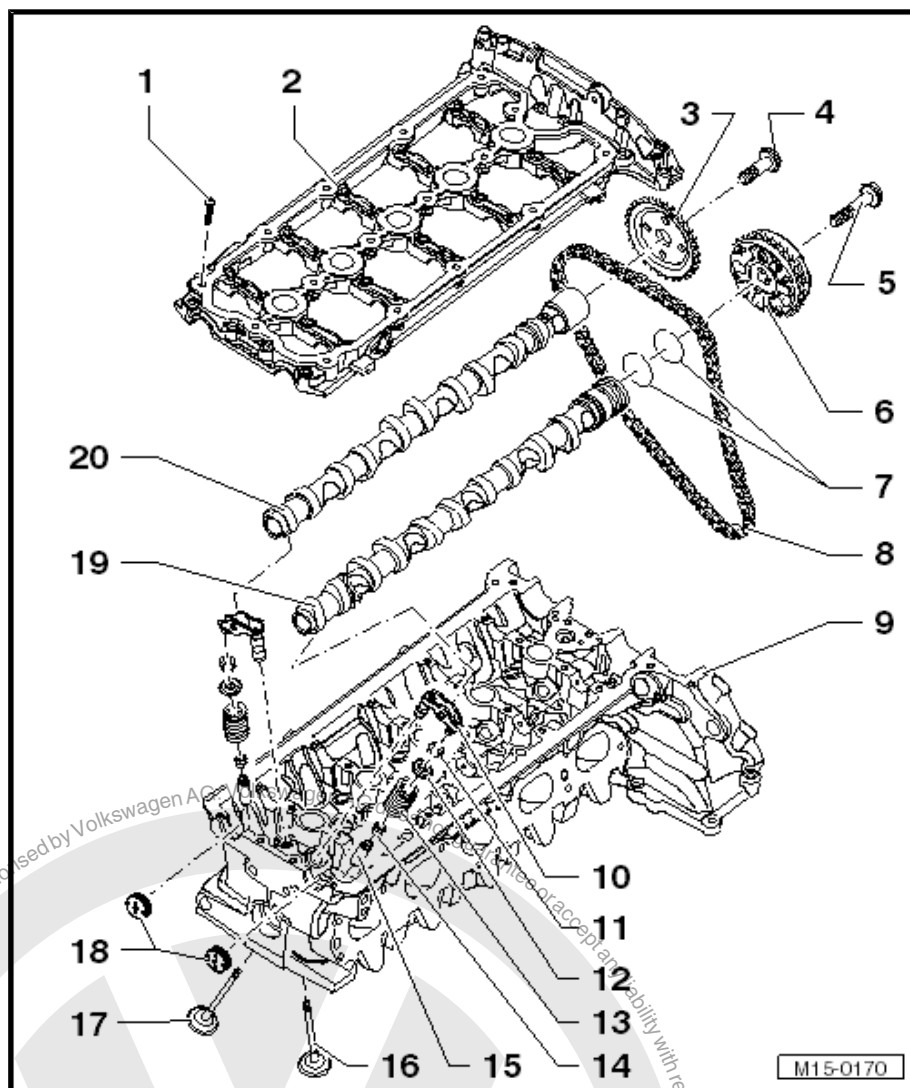
- ☐ Replacing. Refer to ⇒ ["4.3 Valve Stem Seals, Removing and Installing", page 111](#).

15 - Valve Guide

- ☐ Checking. Refer to ⇒ ["5.1 Valve Guides, Checking", page 115](#).

16 - Intake Valve

- ☐ Do not rework, only grinding is permitted





- ☐ Valve dimensions. Refer to ⇒ [“5 Intake and Exhaust Valves”, page 115](#)
- ☐ Valve guides, checking. Refer to ⇒ [“5.1 Valve Guides, Checking”, page 115](#) .

17 - Exhaust Valve

- ☐ Do not rework, only grinding is permitted
- ☐ Valve dimensions. Refer to ⇒ [“5 Intake and Exhaust Valves”, page 115](#)
- ☐ Valve guides, checking. Refer to ⇒ [“5.1 Valve Guides, Checking”, page 115](#) .

18 - Plugs

- ☐ Replace
- ☐ Installing. Refer to ⇒ [“4.2 Camshaft, Removing and Installing”, page 107](#) .

19 - Intake Camshaft

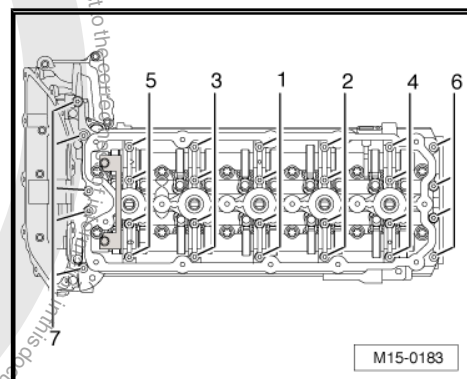
- ☐ Removing and Installing. Refer to ⇒ [“4.2 Camshaft, Removing and Installing”, page 107](#) .
- ☐ Check radial clearance using Plastigage® (roller rocker lever removed)
 Wear limit: 0.1 mm
- ☐ Stroke: maximum 0.035 mm
- ☐ Axial play: maximum 0.17 mm

20 - Exhaust Camshaft

- ☐ Removing and Installing. Refer to ⇒ [“4.2 Camshaft, Removing and Installing”, page 107](#) .
- ☐ Check radial clearance using Plastigage® (roller rocker lever removed)
 Wear limit: 0.1 mm
- ☐ Stroke: maximum 0.035 mm
- ☐ Axial play: maximum 0.17 mm

Tightening Sequence/Torque

Step	Bolts	Tightening Specification/Additional Turn
1.	-1- through -7-	Install hand-tight
2.	-1- through -7-	Tighten with torque wrench to 8 Nm
3.	-1- through -7-	Tighten an additional 90° using a rigid wrench.



4.2 Camshaft, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Sealant - D 154 103 A1-



Removing



Note

- ◆ *Sealing surfaces on guide frame at bottom and on cylinder head at top must not be worked.*
- ◆ *Camshaft bearings are integrated in cylinder head or in guide frame. Before removing guide frame, chain sprockets of camshafts must be removed.*
- ◆ *If guide frame was loosened, sealing plugs must be replaced.*
- Lock the camshafts and remove the chain sprockets from the camshafts (Refer to [⇒ "3.5 Valve Timing, Adjusting", page 99](#)) and adjust the valve timing.
- Remove the Camshaft Clamp - T40070- .
- Remove the bolts for the guide frame evenly from the outside toward the inside and remove the guide frame.
- Carefully remove camshaft upward and place on a clean surface.

Installing



WARNING

To prevent injuries from shavings, wear protective goggles and protective clothing.

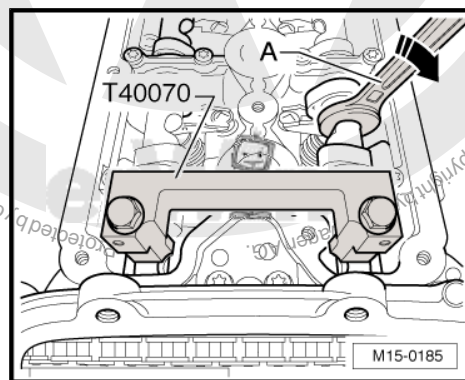
- Remove the sealant residue from the guide frame (out of grooves as well) and from cylinder head for example using a rotating plastic brush.



Caution

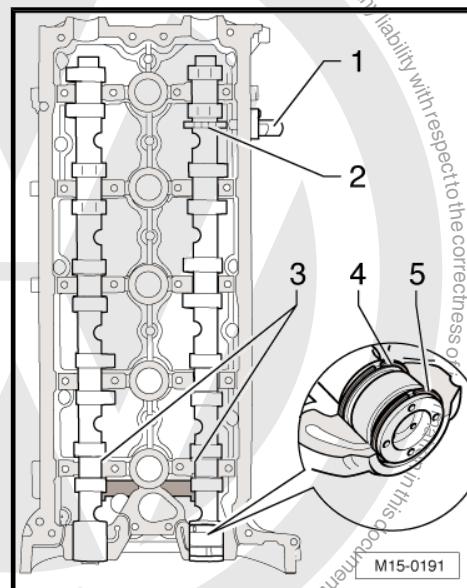
Make sure that no sealant residue gets into the engine.

- Clean the sealing surfaces, they must be free of oil and grease.
- Oil the camshaft running surfaces.
- Place the guide frame on a soft surface.

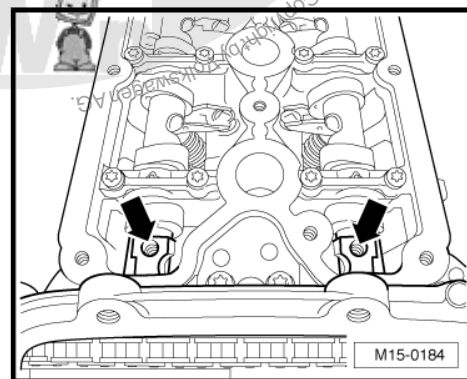




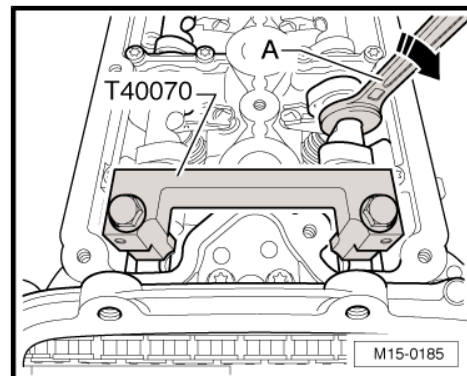
- Place the camshafts correctly in the guide frame.
- ◆ The intake camshaft with sensor wheel -2- points toward the Camshaft Position Sensor - G40- -1-.
- ◆ Camshafts must lie exactly in the axial bearings -3- of guide frame.
- ◆ The seal ends -4- and -5- must point upward or downward.
- ◆ They must not point to the side under any circumstances.
- Slightly turn the guide frame with the inserted camshafts. At the same time hole the camshafts in the guide frame.



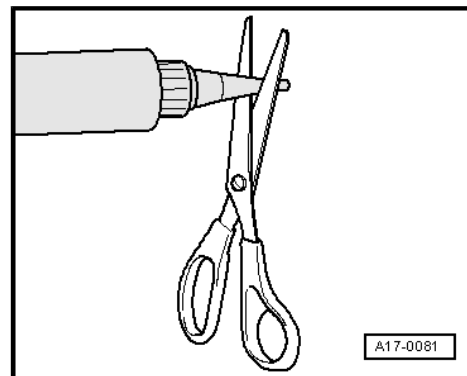
- Rotate the camshafts until the threaded holes -arrows- face upward.
- Check if the camshafts still lie in the guide frame axial bearings.



- Attach the Camshaft Clamp - T40070- to the camshafts as illustrated and tighten the bolts to 20 Nm.
- Turn the guide frame further.



- Cut the tube nozzle at the front marking (nozzle diameter: approximately 1 mm).





- Lightly apply an even sealant bead into the clean grooves of the guide frame -1 to 8- as shown.

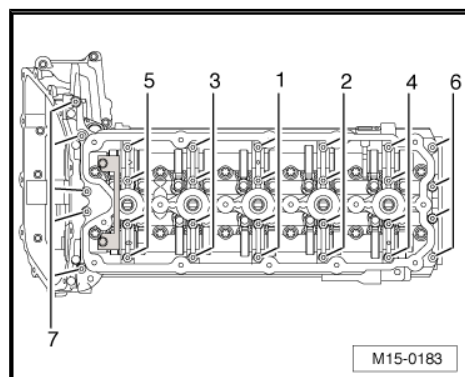
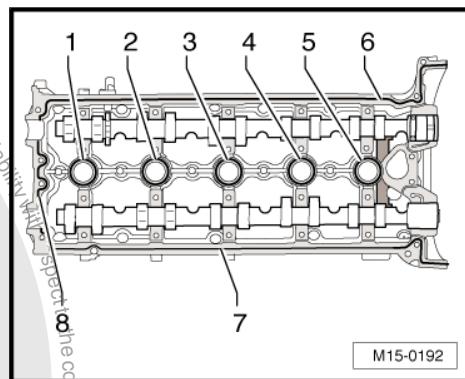
Width of sealant bead:

- ◆ Grooves -1 through 5-: approximately 3.0 mm
- ◆ Grooves -6 through 8-: approximately 4.0 mm

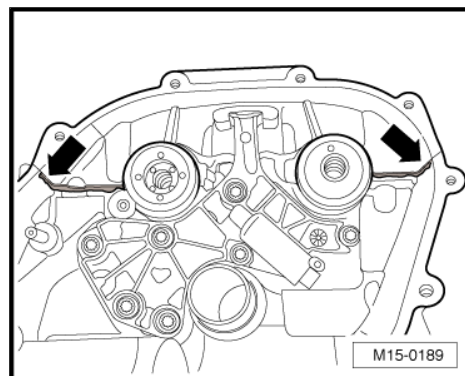


Note

- ◆ Sealant beads must be applied according to exact specifications, otherwise excess sealant could get into the camshaft bearings.
- ◆ Attaching and bolting the guide frame should be performed without interruption because the sealant begins to harden immediately as soon as it contacts the sealing surfaces.
- ◆ Be sure to check the expiration date of the sealant.
- Immediately place the guide frame on the cylinder head.
- Lightly tighten the bolts from inside working toward outside in several stages.
- Tighten the bolts in the sequence shown. Refer to [⇒ Fig. “Tightening Sequence/Torque” page 107](#).



- The sealant must be squeezed out slightly, even in the area of the chain compartment -arrows-.
- Wipe off the sealant from the sealing surface to the timing chain cover.





- Carefully press in the sealing plugs -A- up to the end of the chamfer -arrows-.

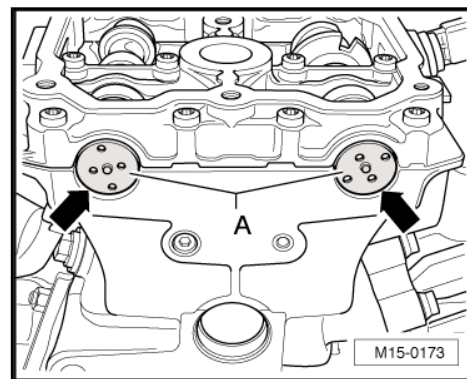


Note

If sealing plug was pressed in too far, it must be pressed through and pressed in anew up to the marking.

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt. Refer to [⇒ "1.3 Knock Sensor 1 G61 , Removing and Installing", page 220](#) .
- ◆ Fill the coolant. Refer to [⇒ "1.4 Coolant, Draining and Filling", page 147](#) .



4.3 Valve Stem Seals, Removing and Installing

(with cylinder head installed)

Special tools and workshop equipment required

- ◆ Spark Plug Removal Tool - 3122B-
- ◆ Puller - Valve Seal - 3364-
- ◆ Seal Installer - Valve Stem - 3365-
- ◆ Valve Cotter Tool Kit - Adapter - T40012-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Valve Keeper Tool Kit - VAS5161A-
- ◆ Valve Cotter Tool Kit - Guide Plate 19C - VAS5161/19C-

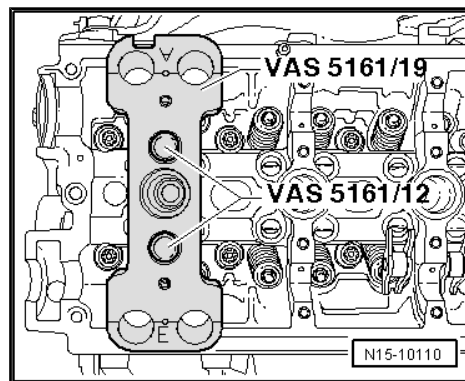
Removing

To remove valve stem seals, the following valves must be removed as follows:

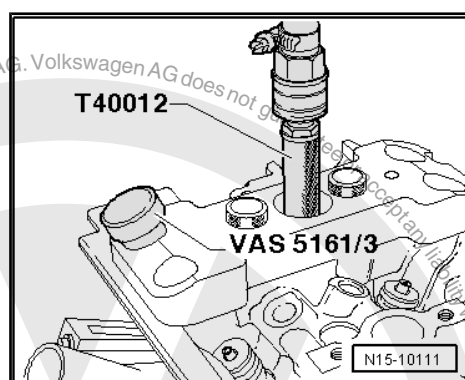
- ◆ Intake valves cylinder 1: transport strap
- ◆ Intake valves cylinder 5: Camshaft Adjustment Valve 1 - N205-
- ◆ Exhaust valves cylinder 5: Secondary Air Injection Solenoid Valve - N112-
- Remove the camshafts. Refer to [⇒ "4.2 Camshaft, Removing and Installing", page 107](#) .
- Remove the roller rocker lever and place it on a clean surface. While doing this, make sure that roller rocker levers are not interchanged.
- Remove the spark plugs using Spark Plug Removal Tool - 3122B- .



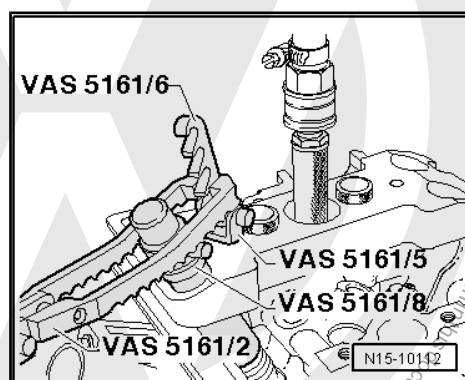
- Install the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- with the Valve Cotter Tool Kit Knurled Thumb Screws M6 - VAS5161/12- as shown on the cylinder head.
- Set the piston for the respective cylinder to the "bottom dead center" position.
- Install the Valve Cotter Tool Kit - Adapter - T40012- into the spark plug thread and apply a constant pressure of at least 6 bar (87 psi) positive pressure.



- Loosen stuck valve retainers using a Punch - VAS5161/3A- and a plastic hammer.



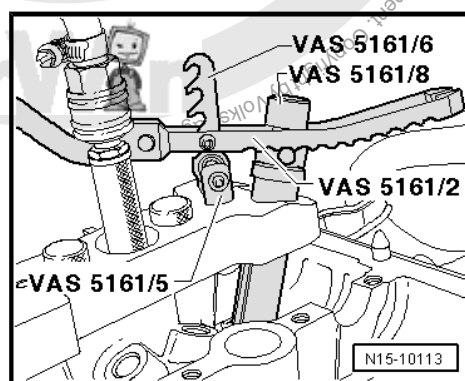
- Install the Valve Cotter Tool Kit - Retainer - VAS5161/6- using the Valve Cotter Tool Kit - Guide Forks M6/M8 Threaded - VAS5161/5- into the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- .
- Place the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8- in the Valve Cotter Tool Kit - Guide Plate 19B - VAS5161/19B- .
- Engage the Pressure Fork With Lever for Assembly Cartridge - VAS5161/2- on the Retainer - VAS5161/6- .



Note

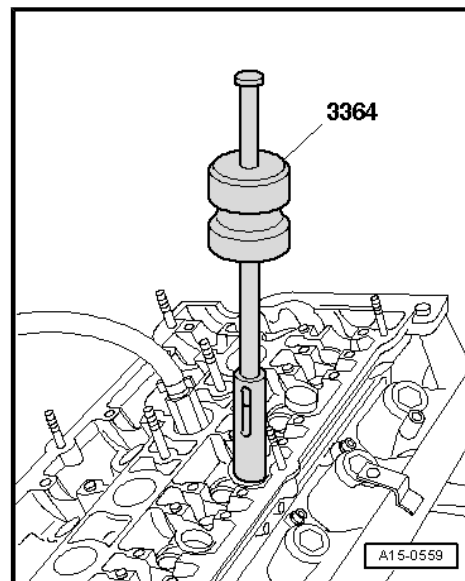
The Valve Cotter Tool Kit - Pressure Fork with lever for Assembly Cartridge - VAS5161/2- engages on the exhaust side as illustrated.

- Press down the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8A- . At the same time, turn the knurled screw of the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8A- to the right, until the points engage in the valve keepers.
- Lightly move knurled bolt of installation cartridge back and forth, this causes the valve retainers to be pressed apart and captured in the installation cartridge.
- Release the Valve Cotter Tool Kit - Pressure Fork With Lever For Assembly Cartridge - VAS5161/2- .
- Remove the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8- , valve spring retainers and valve springs.

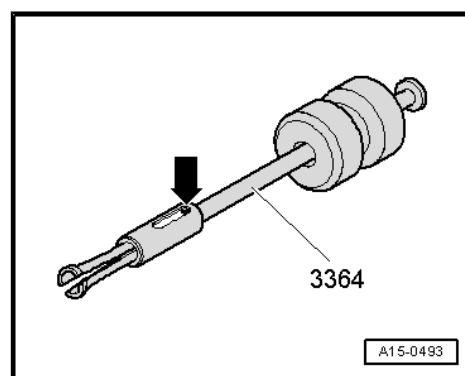




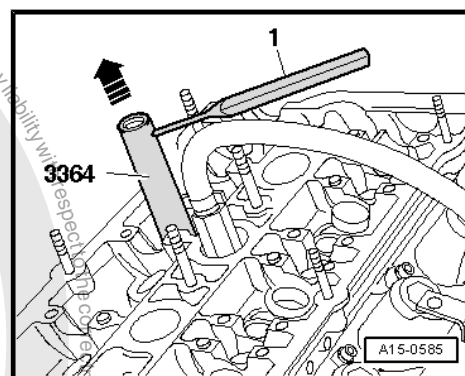
- Remove the valve stem seals using Puller - Valve Seal - 3364- .



- If the Puller - Valve Seal - 3364- cannot be used because there is not enough space, drive the spring pin -arrow- out using a drift and remove the impact attachment.

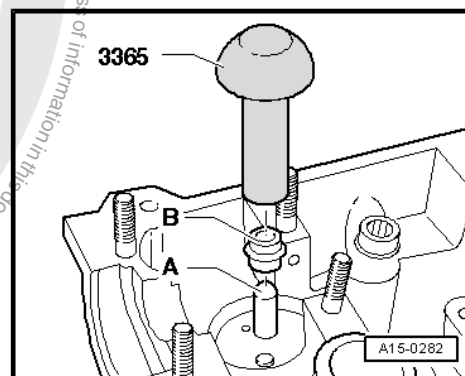


- Position the lower section of the Puller - Valve Seal - 3364- on the valve stem seal.
- Place a drift -1- in the hole in the lower section of the removal tool.
- Place an extractor lever on the assembly tool and remove the valve stem seal in the direction of -arrow-.



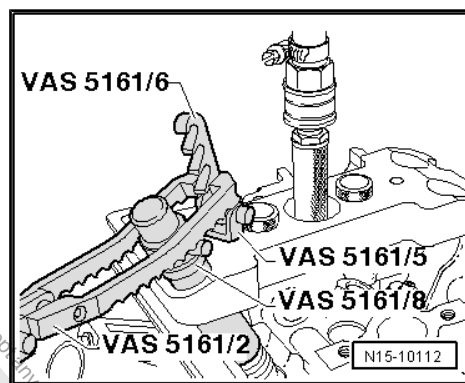
Installing

- Place plastic sleeve -A- on the valve stem to prevent damage to the new valve stem seals -B-.
- Oil the sealing lip of valve stem seal -B-, insert into Seal Installer - Valve Stem - 3365- and carefully slide onto the valve guide.
- Remove the plastic sleeve -A-.
- Insert the valve spring and valve spring retainer.
- Install the Valve Keeper Tool Kit - VAS5161A- as illustrated.

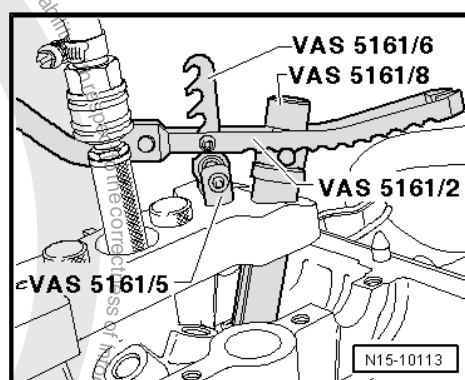




Intake Side



Exhaust Side

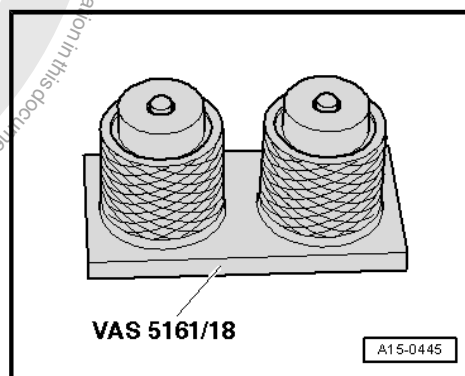


Note

- ◆ If the valve keepers were removed from the assembly cartridge, they must then be inserted into the Valve Insertion Device - VAS5161/18- .
- ◆ Press the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8A- onto the insertion device from above and capture the valve retainers.
- Press down the Valve Cotter Tool Kit - Assembly Cartridge - VAS5161/8- with the Valve Cotter Tool Kit - Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- and lightly tap against the lower part of the installation cartridge.
- Turn the knurled bolt on the installation cartridge back and forth and remove it upward.
- Release the Pressure Fork with Lever for Assembly Cartridge - VAS5161/2- with the knurled thumb screw pulled.
- Remove the Valve Keeper Tool Kit - VAS5161A- .

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt.
- ◆ Fill the coolant. Refer to [⇒ "1.4 Coolant, Draining and Filling", page 147](#) .





5 Intake and Exhaust Valves

⇒ ["5.1 Valve Guides, Checking", page 115](#)

⇒ ["5.2 Valve Dimensions", page 115](#)

5.1 Valve Guides, Checking

Special tools and workshop equipment required

◆ Dial Gauge Holder - VW387-

◆ Dial Gauge

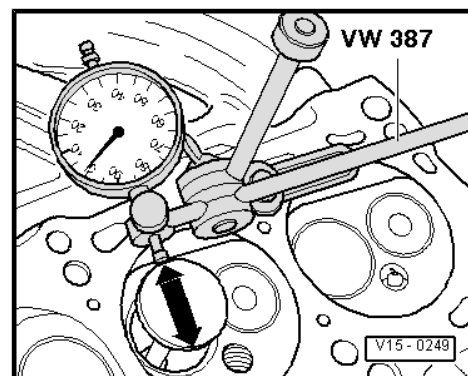
- Insert the new valve into the guide. The tip of the valve stem must seal with the guide. Due to differences in valve stem diameter, make sure that only intake valves are used to check intake valve guides, and only exhaust valves are used to check exhaust valve guides.

- Determine the tilting clearance.

Wear limit: 0.8 mm

If tilt clearance is exceeded:

- Replace the cylinder head. Refer to
⇒ ["1.3 Cylinder Head, Removing and Installing", page 83](#) .



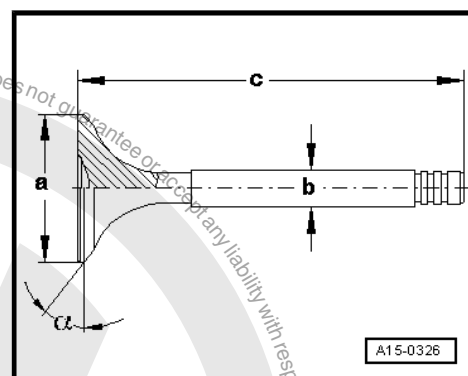
5.2 Valve Dimensions



Note

Intake and exhaust valves must not be reworked. Only grinding is permitted.

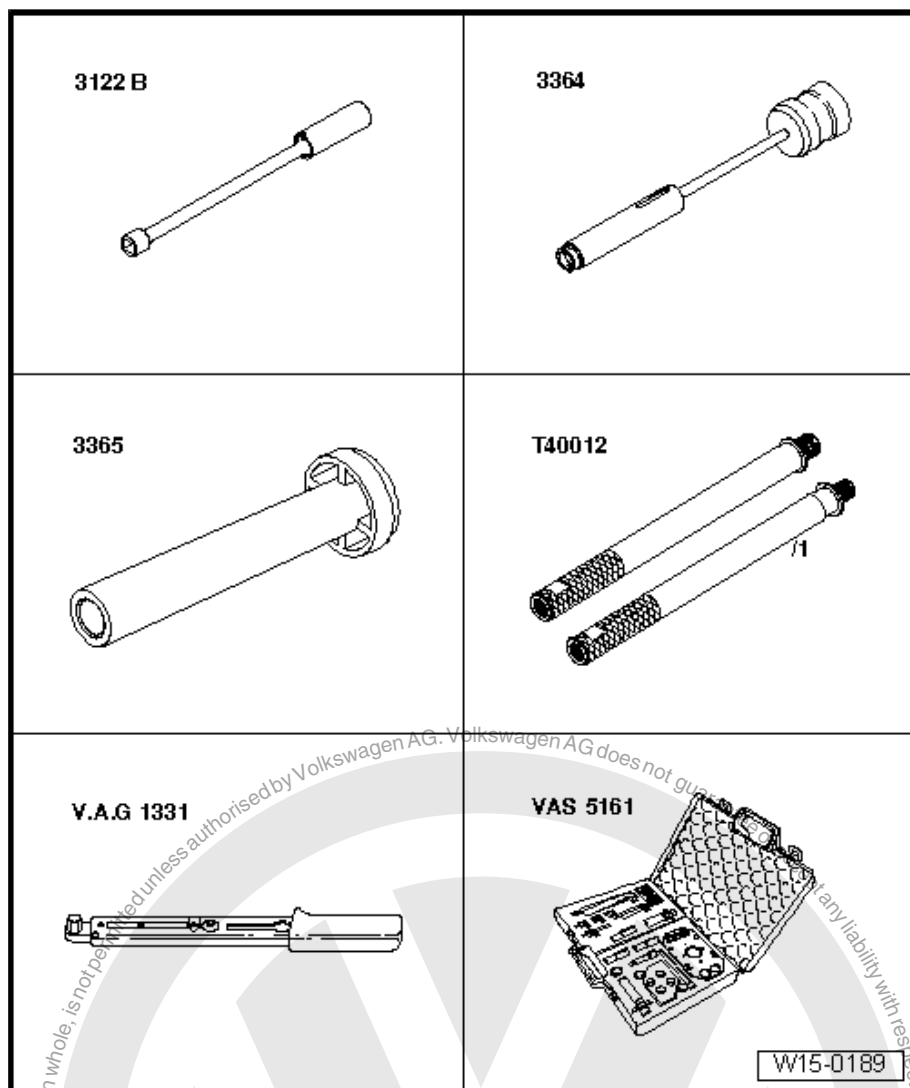
Dimension		Intake Valve	Exhaust Valve
Diameter a	mm	26.80 to 27.00	29.80 to 30.00
Diameter b	mm	5.95 to 5.97	5.94 to 5.95
c	mm	104.84 to 105.34	103.64 to 104.14
α	°	45	45





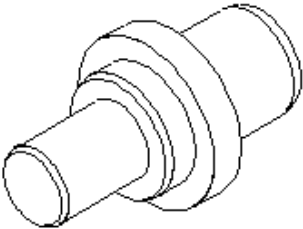
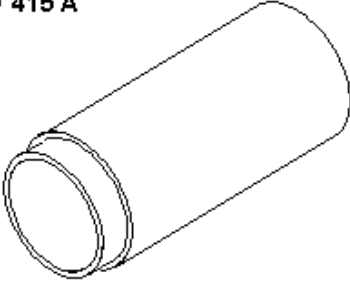
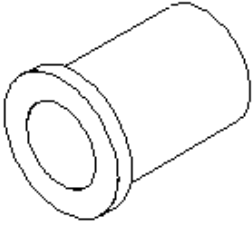
6 Special Tools

Special tools and workshop equipment required



- ◆ Spark Plug Removal Tool - 3122B-
- ◆ Puller - Valve Seal - 3364-
- ◆ Seal Installer - Valve Stem - 3365-
- ◆ Valve Cotter Tool Kit - Adapter - T40012-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Valve Keeper Tool Kit - VAS5161A-
- ◆ Valve Cotter Tool Kit - Guide Plate 19C - VAS5161/19C-

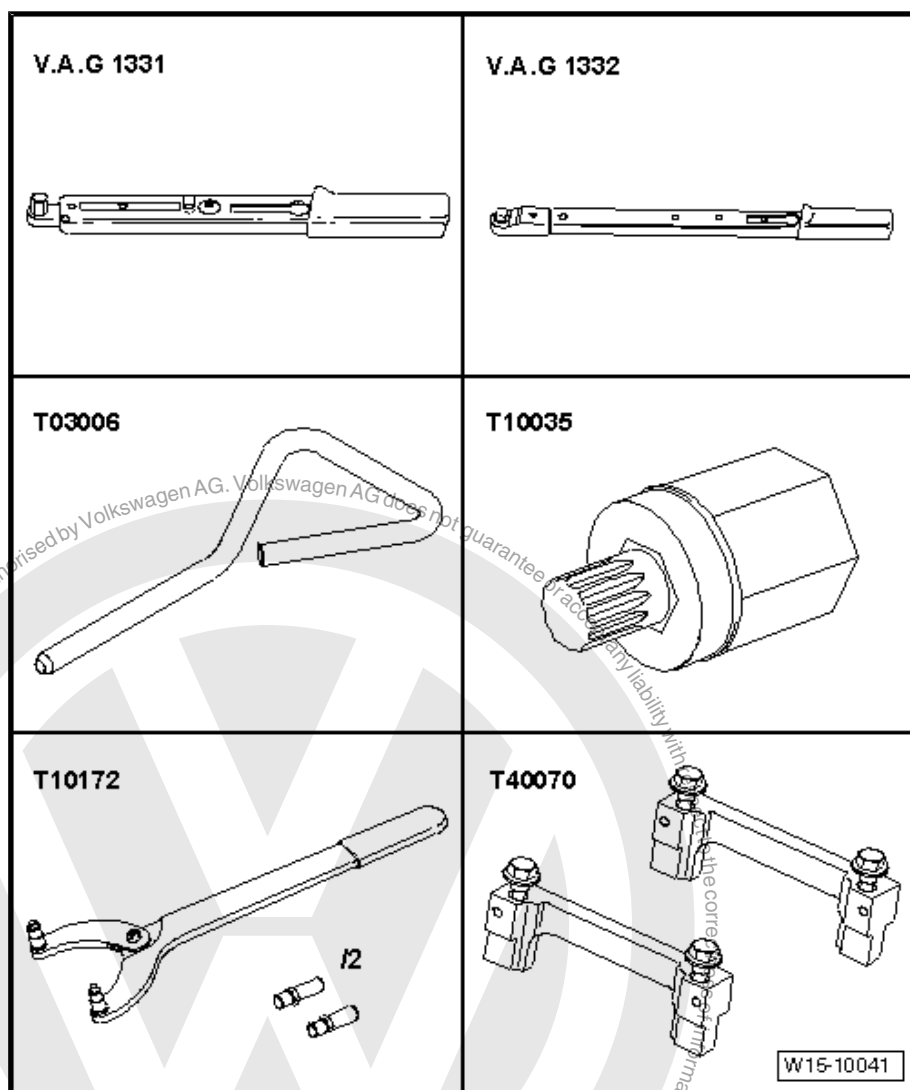


VW 195 	VW 415 A 
3241/4 	
	<div> <p>W15-10040</p> </div>

- ◆ Seal Installer - Drive Axle - VW195-
- ◆ Press Piece - 60mm - VW415A-
- ◆ Seal Installer - Camshaft Installer Kit - Sleeve - 3241/4-

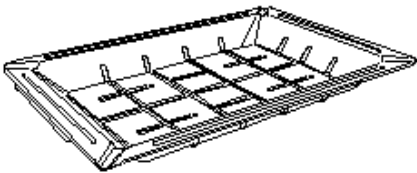


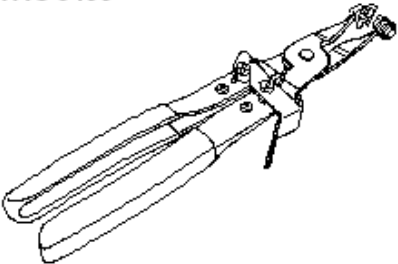
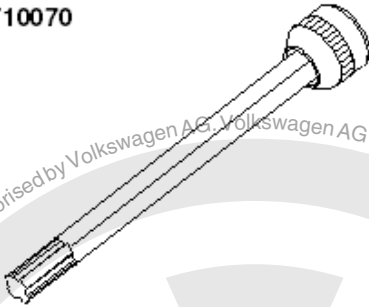
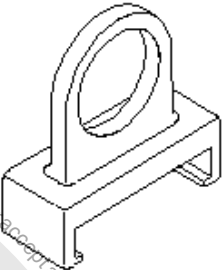


Special tools and workshop equipment required



- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Locking Pins - T03006-
- ◆ Multipoint Socket - T10035-
- ◆ Counterhold - Kit - Multiple Use - T10172-
- ◆ Camshaft Clamp - T40070-
- ◆ Two M8 x 16 bolts

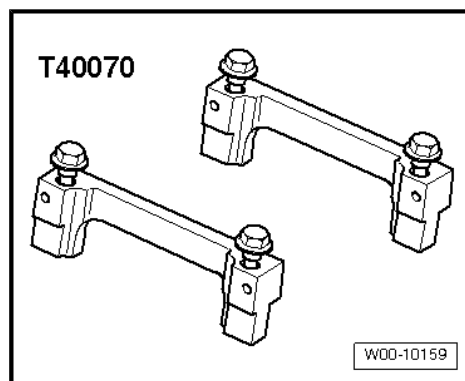


VAS 6208 	V.A.G 1331 
V.A.G 1332 	VAS 6499 
T10070 	T40039  <div style="border: 1px solid black; padding: 2px; width: fit-content; float: right;">W15-10102</div>

- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Torque Wrench 1332 40-200Nm - VAG1332-
- ◆ Spring Clip Pliers - VAS6499-
- ◆ Polydrive Bit Drive Socket - T10070-
- ◆ Puller - Ignition Coil - T40039-
- ◆ Silicone Sealant - D 174 003 A2-



◆ Camshaft Clamp - T40070-



◆ Compression Tester Kit - Adapter 5A - VAG1381/5A-



◆ Compression Tester Kit - VAG1763-



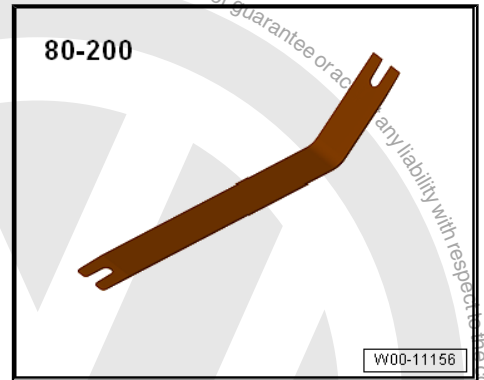
◆ Spark Plug Removal Tool - 3122B-



◆ Fuel Injection Gauge Kit - Adapter VAG1381/1 - VAG1381/1-



◆ Pry Lever - 80-200-





17 – Lubrication

1 Oil Pan/Oil Pump

⇒ [“1.1 Engine Oil”, page 122](#)

⇒ [“1.2 Overview - Oil Pan/Oil Pump”, page 122](#)

⇒ [“1.3 Oil Pan Lower Section, Removing and Installing”, page 124](#)

⇒ [“1.4 Oil Pan Upper Section, Removing and Installing”, page 126](#)

⇒ [“1.5 Oil Pump, Removing and Installing”, page 129](#)

1.1 Engine Oil

Oil Capacities

Refer to ⇒ Fluid Capacity Tables; Rep. Gr. 03

If necessary, fill up to the MAX marking on the oil dipstick.

Viscosity Classes and Oil Specifications

Refer to the ⇒ Maintenance ; Booklet 38 “Maintenance Tables”.

Oil Dipstick Markings

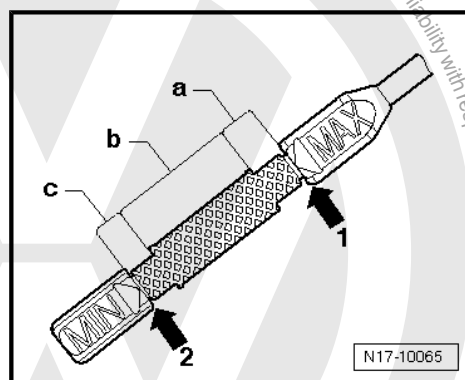
1 - MAX marking

2 - MIN marking

a - Oil level is near the MAX mark: do not add oil!

b - Oil level in the center: engine oil can be filled.

c - Oil level is near the MIN mark: fill with approximately 0.5 liters (0.52 quarts) of oil!



1.2 Overview - Oil Pan/Oil Pump



Note

- ♦ If large quantities of metal shavings or abraded material are detected during engine repairs, it may mean the crankshaft or connecting rod bearings are damaged. Perform the following procedure after the repair to prevent subsequent damage.
- ♦ Clean the oil channels carefully.
- ♦ Replace the oil spray jets.
- ♦ Replace the engine oil cooler.
- ♦ Replace the oil filter.
- ♦ The oil level must not go above the MAX mark - danger of causing damage to the catalytic converter!



1 - Cylinder Block

2 - Reduced Oil Pressure Switch - F378-

- ☐ 20 Nm
- ☐ Only installed on vehicles with engine codes CBTA and CBUA.
- ☐ Removing and Installing. Refer to [⇒ "2.1 Overview - Oil Filter Housing/Oil Pressure Switch", page 132](#).
- ☐ Checking see Vehicle Diagnostic Tester "Guided Fault Finding" function

3 - Oil Pressure Switch - F1-

- ☐ 20 Nm
- ☐ Removing and Installing. Refer to [⇒ "2.1 Overview - Oil Filter Housing/Oil Pressure Switch", page 132](#).
- ☐ Checking see Vehicle Diagnostic Tester "Guided Fault Finding" function

4 - Oil Pressure Regulation Valve - N428-

- ☐ Only installed on vehicles with engine codes CBTA and CBUA.
- ☐ Removing and Installing. Refer to [⇒ "2.1 Overview - Oil Filter Housing/Oil Pressure Switch", page 132](#).
- ☐ Checking see Vehicle Diagnostic Tester "Guided Fault Finding" function

5 - Power Take-Off Drive Chain

6 - Bolt

- ☐ 20 Nm +90°
- ☐ Replace after removing

7 - Chain Sprocket for Oil Pump

- ☐ Removing and Installing. Refer to [⇒ "1.5 Oil Pump, Removing and Installing", page 129](#).
- ☐ The letters face outward
- ☐ With anti-twist mechanism

8 - Oil Pump

- ☐ Removing and Installing. Refer to [⇒ "1.5 Oil Pump, Removing and Installing", page 129](#).

9 - Bolt

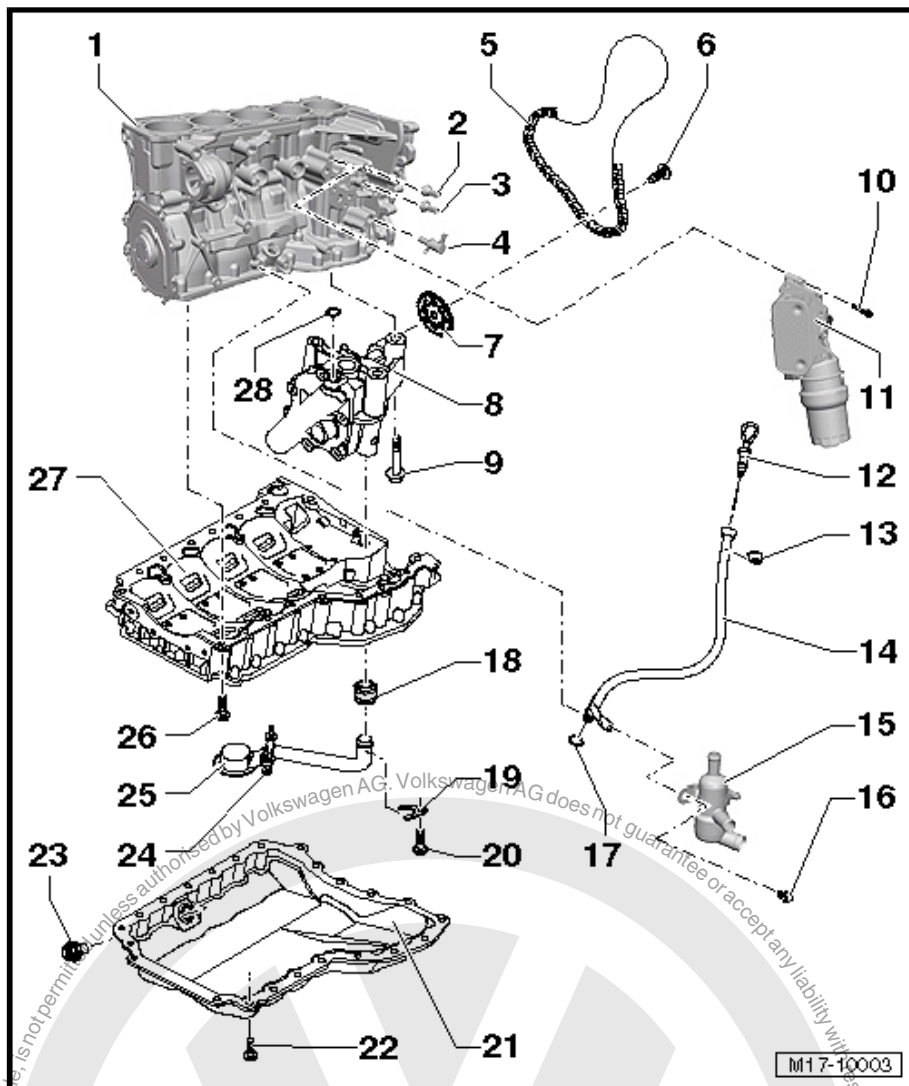
- ☐ 25 Nm

10 - Bolt

- ☐ 25 Nm

11 - Oil Filter Bracket with Attachments

- ☐ Overview. Refer to [⇒ "2.1 Overview - Oil Filter Housing/Oil Pressure Switch", page 132](#).





12 - Oil Dipstick

- ☐ Oil level must not be above the max. mark!

13 - Retaining Ring

- ☐ Clipped in intake manifold

14 - Guide Tube

15 - Preheater

- ☐ Only vehicles with engine preheater

16 - Bolt

- ☐ 25 Nm

17 - O-Ring

- ☐ Replace after removing

18 - Seal

- ☐ Replace after removing

19 - Bracket

20 - Bolt

- ☐ 10 Nm

21 - Oil Pan Lower Section

- ☐ Removing and Installing. Refer to ⇒ ["1.4 Oil Pan Upper Section, Removing and Installing", page 126](#) .

22 - Bolt

- ☐ 10 Nm

23 - Oil Drain Plug

- ☐ 30 Nm
- ☐ Replace after removing

24 - Decoupling element

- ☐ 10 Nm
- ☐ Bolt

25 - Oil Intake Pipe

26 - Bolt

- ☐ 25 Nm

27 - Oil Pan Upper Section

- ☐ Removing and Installing. Refer to ⇒ ["1.4 Oil Pan Upper Section, Removing and Installing", page 126](#) .

28 - O-Ring

- ☐ Replace after removing

1.3 Oil Pan Lower Section, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Silicone Sealant - D 174 003 A2-

Removing

- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



- Drain the engine oil.



Note

Observe the disposal regulations!

- Remove the bolts.
- Press the oil pan lower section off at the tabs -arrows- on the oil pan upper section.
- Replace the oil pan lower section if damaged.

Installing



WARNING

To prevent injuries from shavings, wear protective goggles and protective clothing.

- Remove any sealant residue on the cylinder block and the oil pan upper section using a rotating plastic brush.



Caution

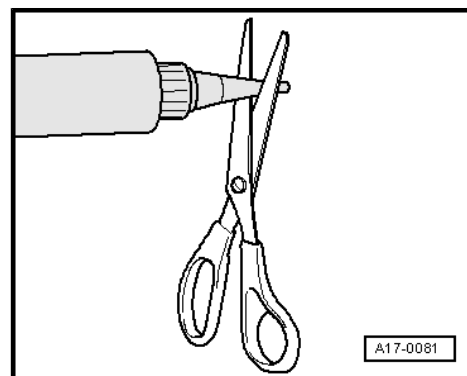
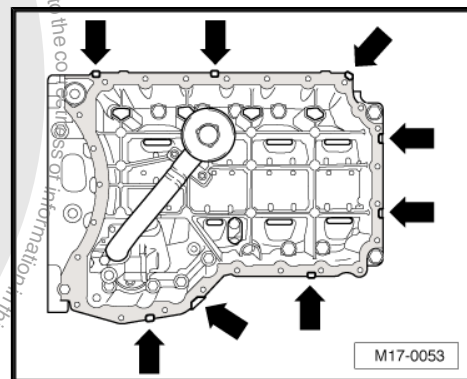
Make sure that no sealant residue gets into the engine.

- Clean the sealing surfaces, they must be free of oil and grease.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 1 mm).
Be sure to check the expiration date of the sealant.



Note

The oil pan (lower part) must be installed within 5 minutes after application of sealant.





- With the engine removed, apply a sealant bead -A- on the clean sealing surface on the oil pan upper section as illustrated.
- ◆ The sealant bead must be 1.5 to 2.0 mm thick.



Note

- ◆ *With the engine installed, apply the sealant to the oil pan lower section the same way.*
- ◆ *Sealant bead must be routed on inside on holes for bolts.*

- Install all the bolts and tighten them diagonally.

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ◆ After installing the oil pan lower section, the sealant must dry for approximately 30 minutes. Only after then may the engine oil be replenished.

Tightening Specifications

- ◆ Refer to ➔ ["1.2 Overview - Oil Pan/Oil Pump", page 122](#)

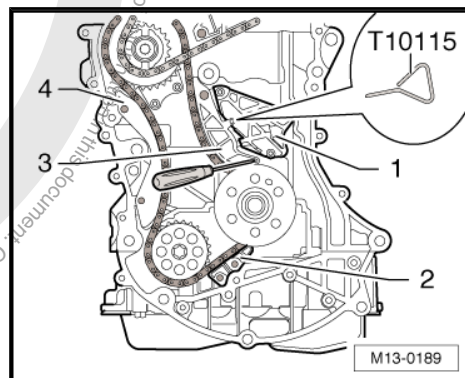
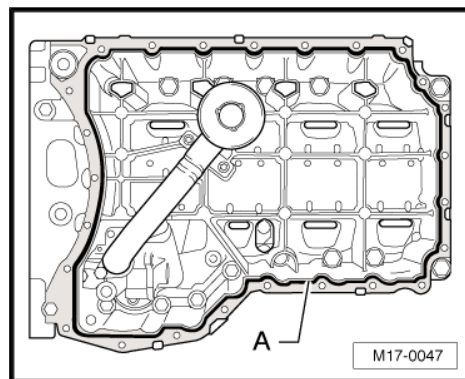
1.4 Oil Pan Upper Section, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Locking Pin - T10115-
- ◆ Seal Installer - Valve Stem Seal Tool Adapter Plates - 2036/1- (not illustrated)
- ◆ Three M 8 x 30 bolts, three washers
- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Silicone Sealant - D 174 003 A2-

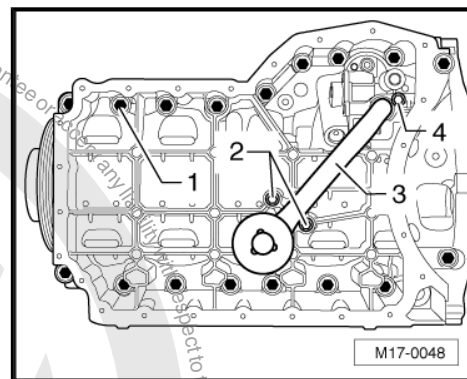
Removing

- Loosen the camshaft gears. Refer to ➔ ["3.5 Valve Timing, Adjusting", page 99](#) .
- Remove the control housing cover. Refer to ➔ ["2.7 Sealing Flange, Removing and Installing, Transmission Side", page 59](#) .
- Tension the chain tensioner -1- and lock with the Locking Pin - T10115- .
- Remove the glide rail -2-.
- Remove the sealing flange for the crankshaft - belt pulley side. Refer to ➔ ["1.7 Crankshaft Seal, Replacing, Belt Pulley Side", page 51](#) .
- Remove the oil pan lower section. Refer to ➔ ["1.3 Oil Pan Lower Section, Removing and Installing", page 124](#) .





- Remove the bolts -2- and -4- and the oil intake pipe.
- Remove the bolts -1-.



- Press the oil pan upper section off the cylinder block using a suitable screwdriver -A- at the areas shown.

B - Crankshaft Bearing Cap 6

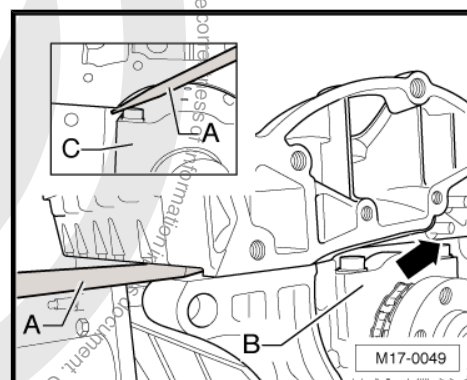
C - Crankshaft Bearing Cap 1

Installing



WARNING

To prevent injuries from shavings, wear protective goggles and protective clothing.



- Remove any sealant residue from the oil pan upper section and the cylinder block using for example a rotating plastic brush.



Caution

Make sure that no sealant residue gets into the engine.

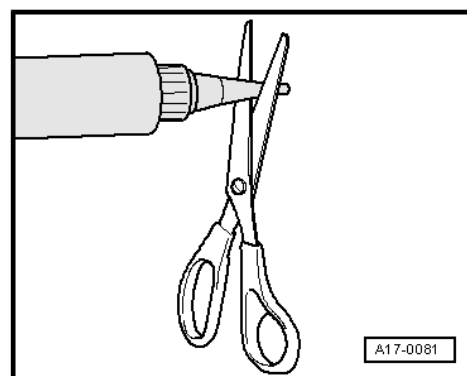
- Clean the sealing surfaces, they must be free of oil and grease.
- Cut the tube nozzle at the front marking (nozzle diameter: approximately 1 mm).

Be sure to check the expiration date of the sealant.



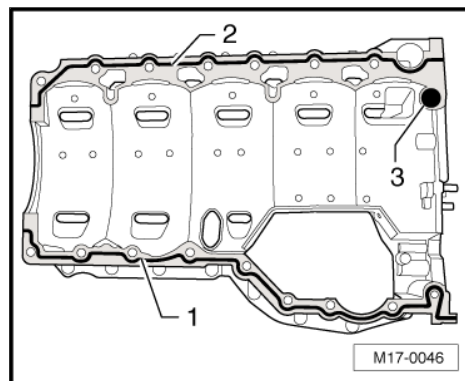
Note

The oil pan (upper part) must be installed within five minutes after application of sealant.

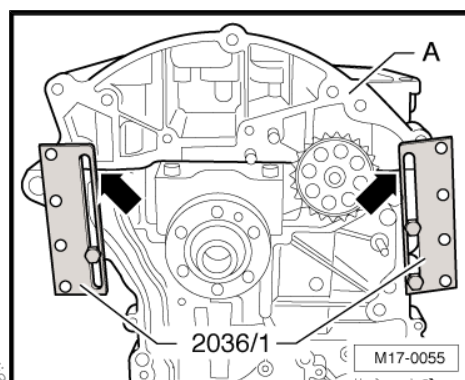




- Apply sealant beads -1-, -2- and -3- to the clean sealing surfaces on the oil pan upper section as illustrated.
- The sealant bead must be 1.5 to 2.0 mm thick.
- Place the oil pan upper section on the cylinder block and align it on the transmission side.
- Install two bolts respectively at the front and rear hand-tight.



- Wipe off any excess sealant in the area of the -arrows-.
- Loosen the bolts slightly again.
- Attach the Seal Installer - Valve Stem Seal Tool Adapter Plates - 2036/1- from the Seal Installer - Valve Stem Seal Tool - 2036- to the cylinder block.
- Push the oil pan upper section securely on the Seal Installer - Valve Stem Seal Tool Adapter Plates - 2036/1- and tighten the bolts hand-tight.
- Install the remaining bolts and tighten hand-tight.

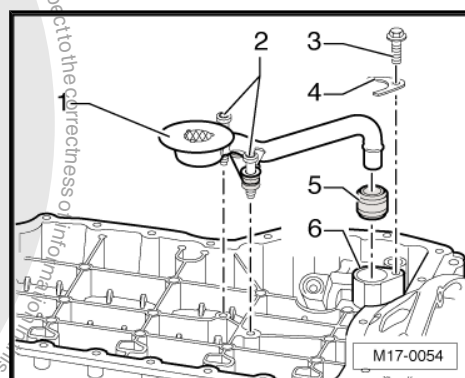


At the same time pay attention that the oil pan upper section seated flush on the Seal Installer - Valve Stem Seal Tool Adapter Plates - 2036/1- .

- Tighten all bolts from the inside toward the outside diagonally.

Install the new seal -5- in the oil pump -6-.

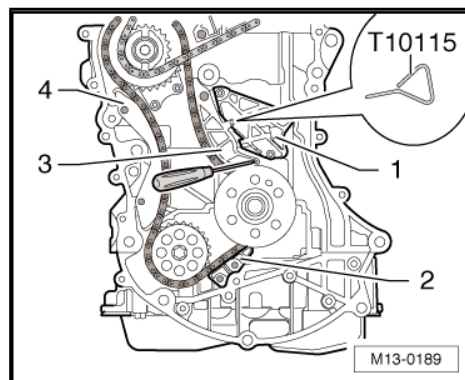
Install the oil intake pipe -1- using the bolts -2- and -3- as well as the bracket -4-.



- Install the glide rail -2-, release the chain tensioner -1- tension and remove the Locking Pin - T10115.
- Adjust the valve timing. Refer to [⇒ "3.5 Valve Timing, Adjusting", page 99](#).

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ♦ After installing the oil pan, allow the sealant to dry for approximately 30 minutes. Only after then may the engine oil be replenished.
- ♦ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt.
- ♦ Fill the coolant. Refer to [⇒ "1.4 Coolant, Draining and Filling", page 147](#).



Tightening Specifications

- ♦ Refer to [⇒ "1.2 Overview - Oil Pan/Oil Pump", page 122](#)



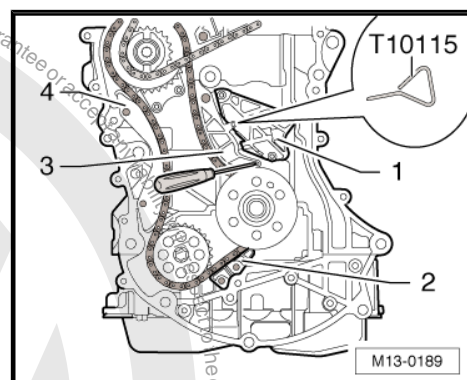
1.5 Oil Pump, Removing and Installing

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Counterhold - Kit - Multiple Use - T10172-
- ◆ Oil Pump Alignment Plate - T03005-
- ◆ Oil Pump Shim - T03005/1-

Removing

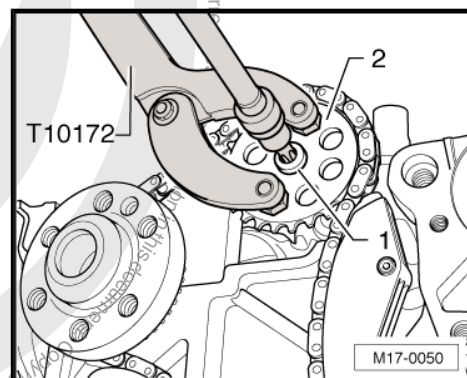
- Remove the oil pan upper section. Refer to
 ⇒ ["1.4 Oil Pan Upper Section, Removing and Installing", page 126](#) .
 - Tension the chain tensioner -1- and lock with the Locking Pin - T10115- and remove
 - Remove the bolt -1-.
- Hold the chain sprocket -2- securely with the Counterhold - Kit - Multiple Use - T10172- .



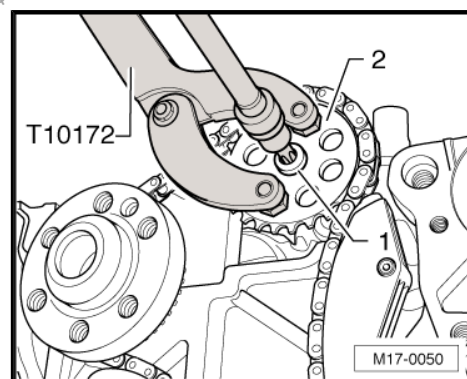
- Remove the chain sprocket from the oil pump and remove the oil pump.

Installing

- Crankshaft is secured
- Replace the O-ring -item 28- ⇒ [Item 28 \(page 124\)](#) .



- Attach the oil pump to cylinder block hand-tight.
- Place chain sprocket with lettering facing outward on to oil pump shaft and secure it with a new bolt -1- (drive chain not yet installed).



Bolt	Tightening Specifications
1. -1-	20 Nm
2. -1-	90°



- Loosen the bolts -2- to 4-.
- Oil pump must be able to be slid easily.
- Check the Oil Pump Alignment Plate - T03005- if the protective shields are still on the magnets and if necessary remove them.
- Make sure there are no shavings on the magnets on the Oil Pump Alignment Plate - T03005A- .
- The contact surfaces on the crankshaft, the tools and the chain sprocket must be clean.



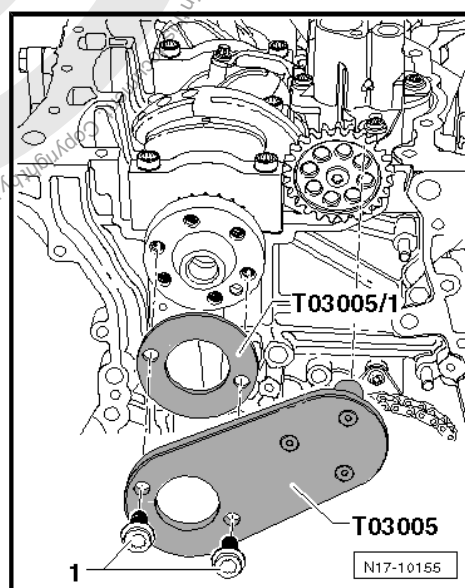
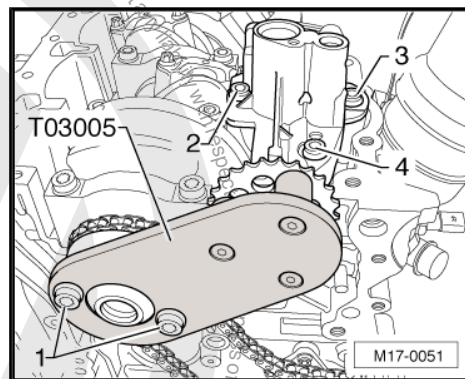
Caution

The Oil Pump Shim - T03005/1- must be used.

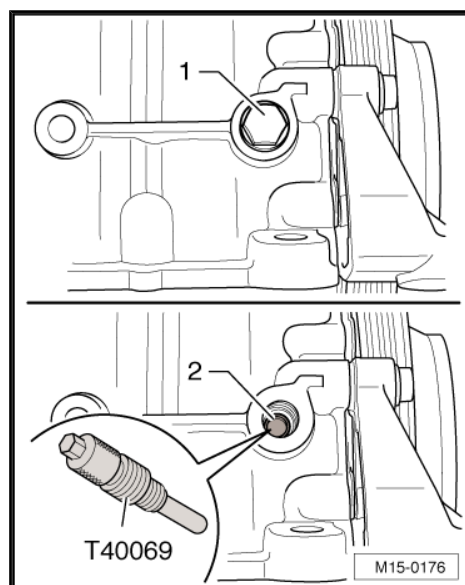
- Place the Oil Pump Shim - T03005/1- and the Oil Pump Alignment Plate - T03005- on the crankshaft journal.
- Install both with two bolts -1- from the vibration damper/belt pulley.

Bolts	Tightening Specifications
-1-	30 Nm

Oil pump is activated by magnets.

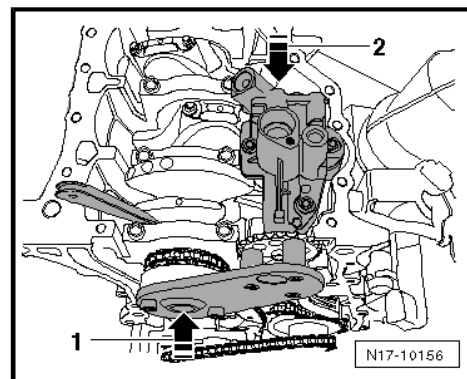


- Remove the Crankshaft Locking Pin - T40069- .





- Push the crankshaft in the axial bearing play toward the belt drive in the direction of -arrow 1- and secure it with a -wedge- as shown.



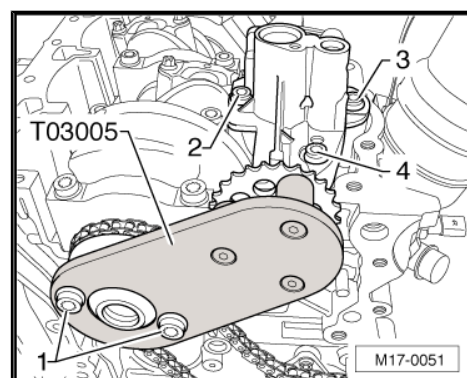
- Press the oil pump lightly toward the chain drive in the direction of -arrow 2-.



Note

This work step is important in order to guarantee correct position of chain sprockets to each other.

Steps	Tightening Sequence and Tightening Specification
1. Bolts -2- and -3-	Pre-tighten to 25 Nm
2. Bolt -4-	Pre-tighten to 25 Nm



- Reinstall the Crankshaft Locking Pin - T40069- . Crankshaft must only be rotated slightly around TDC point for this. Otherwise there is a risk the valves rest on the pistons.
- Remove the Oil Pump Alignment Plate - T03005- and the Oil Pump Shim - T03005/1- .
- If a new oil pump is installed, fill oil pump with some engine oil via the intake duct and rotate oil pump several times through.
- Place the drive chain on to the oil pump chain sprocket.
- Install the oil pan upper section. Refer to ["1.3 Oil Pan Lower Section, Removing and Installing", page 124](#) .
- Install the glide rail -2-, release the chain tensioner -1- tension and remove the Locking Pin - T10115- .



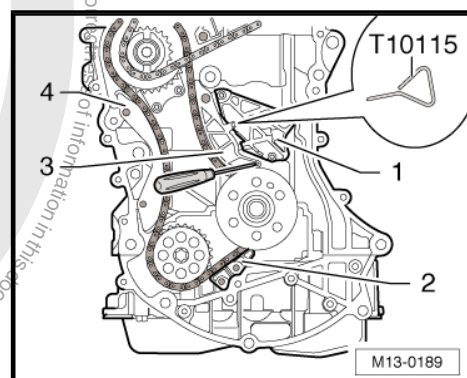
Note

Make sure that drive chain lies correct in glide track -4- and in tensioning track -3-.

- Adjust the valve timing. Refer to ["3.5 Valve Timing, Adjusting", page 99](#) .

The rest of the installation follows the reverse of the removal procedures. Note the following:

- ♦ Remove the Crankshaft Locking Pin - T40069- from the back of the cylinder block and install the bolt. Refer to ["1.3 Knock Sensor 1 G61, Removing and Installing", page 220](#) .
- ♦ Fill the coolant. Refer to ["1.4 Coolant, Draining and Filling", page 147](#) .



2 Oil Filter/Oil Pressure Switch

⇒ ["2.1 Overview - Oil Filter Housing/Oil Pressure Switch", page 132](#)

⇒ ["2.2 Oil Filter Housing, Draining", page 134](#)

⇒ ["2.3 Oil Pressure and Oil Pressure Switch, Checking", page 135](#)

2.1 Overview - Oil Filter Housing/Oil Pressure Switch

1 - Bolt

- ☐ 25 Nm

2 - Oil Filter Bracket

- ☐ Removing and Installing. Refer to [⇒ "2.4 Oil Filter Housing, Removing and Installing", page 139](#).

3 - Seal

- ☐ Replace after removing

4 - Oil Pressure Switch - F1-

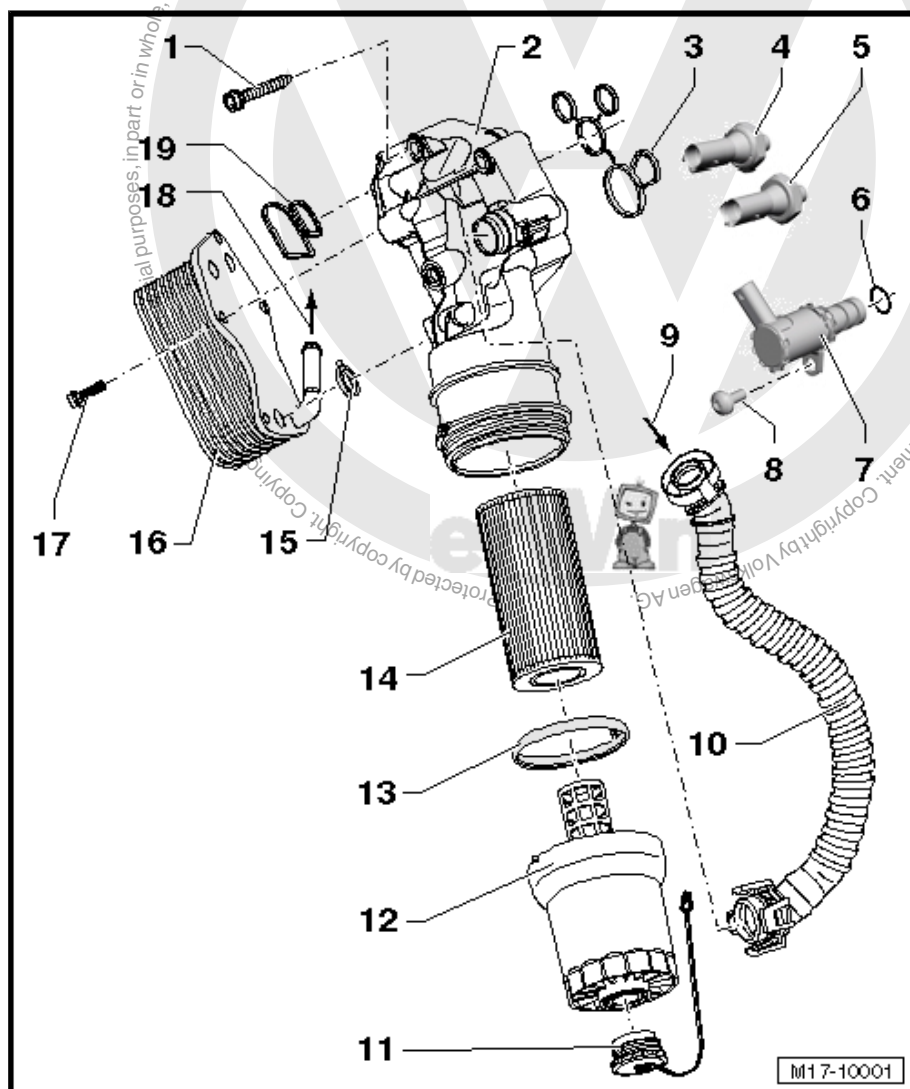
- ☐ 20 Nm
- ☐ Blue 1-pin connector
- ☐ Switching pressure 2.15 to 2.95 bar (31.18 to 42.78 psi)
- ☐ Installed position inside the vehicle. Refer to [⇒ Fig. "Installed Position - Oil Pressure Switch and Oil Pressure Regulation Valve", page 134](#)
- ☐ Checking. Refer to [⇒ "2.3.3 Oil Pressure Switch, Checking, Vehicles with Engine Codes CBTA, CBUA", page 136](#).

5 - Reduced Oil Pressure Switch - F378-

- ☐ 20 Nm
- ☐ Only installed on vehicles with engine codes CBTA and CBUA.
- ☐ Brown, 1 pin
- ☐ Switching pressure: 0.55 to 0.85 bar (7.97 to 12.32 psi)
- ☐ Installed position inside the vehicle. Refer to [⇒ Fig. "Installed Position - Oil Pressure Switch and Oil Pressure Regulation Valve", page 134](#)
- ☐ Checking. Refer to [⇒ "2.3.3 Oil Pressure Switch, Checking, Vehicles with Engine Codes CBTA, CBUA", page 136](#).

6 - O-Ring

- ☐ Only installed on vehicles with engine codes CBTA and CBUA.
- ☐ Replace after removing





7 - Oil Pressure Regulation Valve - N428-

- ☐ Only installed on vehicles with engine codes CBTA and CBUA.
- ☐ Installed position inside the vehicle. Refer to
⇒ [Fig. “Installed Position - Oil Pressure Switch and Oil Pressure Regulation Valve”](#), page 134
- ☐ Checking see Vehicle Diagnostic Tester “Guided Fault Finding” function

8 - Bolt

- ☐ 9 Nm
- ☐ Only installed on vehicles with engine codes CBTA and CBUA.

9 - From Intake Hose

10 - Vent Hose

- ☐ Because of 4-pin retainer, disconnect only when oil filter is removed

11 - Dust Cap

12 - Oil Filter Housing

- ☐ 25 Nm
- ☐ Remove and install using the Wrench - Oil Filter - 3417-
- ☐ Draining. Refer to ⇒ [“2.2 Oil Filter Housing, Draining”](#), page 134 .

13 - Seal

- ☐ No replacement part, part of the oil filter
- ☐ Insert when oiled
- ☐ Installed position: position indicator at the top

14 - Oil Filter

- ☐ Drain the oil filter housing before removing the oil filter. Refer to
⇒ [“2.2 Oil Filter Housing, Draining”](#), page 134 .
- ☐ Replacing. Refer to ⇒ Maintenance ; Booklet ; Engine Oil: Draining or Extracting; Oil Filter, Replacing and Filling Engine Oil .

15 - Seal

- ☐ Replace after removing

16 - Engine Oil Cooler

- ☐ See note. Refer to ⇒ [“1 Oil Pan/Oil Pump”](#), page 122 .
- ☐ Make sure there is enough space to the surrounding components
- ☐ Coolant Hose Connection Diagram. Refer to ⇒ [“1.1 Connection Diagram - Coolant Hoses”](#), page 144 .

17 - Bolt

- ☐ 25 Nm

18 - To Thermostat Housing

19 - Seal

- ☐ Replace after removing



Installed Position - Oil Pressure Switch and Oil Pressure Regulation Valve

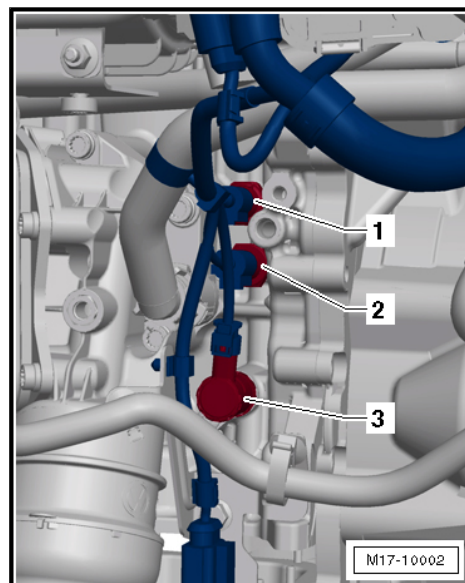
1 - Oil Pressure Switch - F1- , blue

2 - Reduced Oil Pressure Switch - F378- , brown

Only installed on vehicles with engine codes CBTA and CBUA.

3 - Oil Pressure Regulation Valve - N428-

Only installed on vehicles with engine codes CBTA and CBUA.



2.2 Oil Filter Housing, Draining

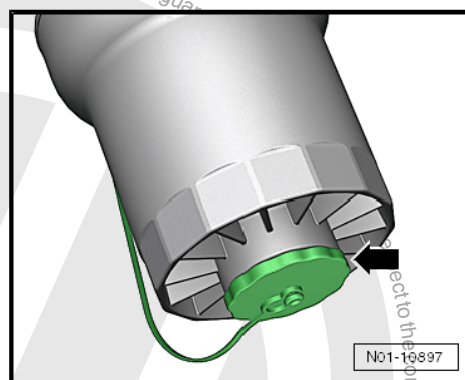


Note

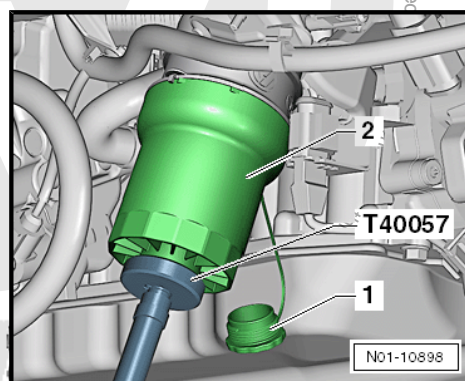
When screwing in the Oil Drain Adapter - T40057- , a valve in the oil filter housing is opened. If the Oil Drain Adapter - T40057- is unscrewed, the valve closes again.

Special tools and workshop equipment required

- ◆ Oil Drain Adapter - T40057-
- Remove the dust cap -arrow- from the oil filter housing.



- Hold the hose from the Oil Drain Adapter - T40057- in a drip tray and install the Oil Drain Adapter - T40057- all the way in the oil filter housing -2-.
- Drain the engine oil.





2.3 Oil Pressure and Oil Pressure Switch, Checking

⇒ [“2.3.1 Oil Pressure, Checking, Vehicles with Engine Codes CBTA, CBUA”, page 135](#)

⇒ [“2.3.2 Oil Pressure, Checking, Vehicles with Engine Code CCCA”, page 135](#)

⇒ [“2.3.3 Oil Pressure Switch, Checking, Vehicles with Engine Codes CBTA, CBUA”, page 136](#)

⇒ [“2.3.4 Oil Pressure Switch, Checking, Vehicles with Engine Code CCCA”, page 138](#)

2.3.1 Oil Pressure, Checking, Vehicles with Engine Codes GBTA, CBUA

Special tools and workshop equipment required

- ◆ Oil Pressure Gauge Kit - VAG1342-
- ◆ Socket and Jointed Extension - 24mm - T40175-

Procedure

- Oil level OK
- Engine oil temperature approximately 80 °C (176 °F)
- Disconnect the connector -2- from the Reduced Oil Pressure Switch - F378- (brown).
- Remove the Reduced Oil Pressure Switch - F378- .
- Connect the Oil Pressure Gauge Kit - VAG1342- in the opening for the oil pressure switch.
- Install the Reduced Oil Pressure Switch - F378- in the oil pressure tester.
- Start the engine.
- Oil pressure when the vehicle is idling: 1.2 to 2.1 bar (17.4 to 30.45 psi)
- Oil pressure at 2000 RPM: 1.6 to 2.1 bar (23.2 to 30.45 psi).
- Oil pressure at 3700 RPM: 3.0 to 4.0 bar (43.5 to 58 psi)



Note

The oil pressure may be 3.0 to 4.0 bar (43.5 to 58 psi) at 2,000 RPM during the first 1,000 km.

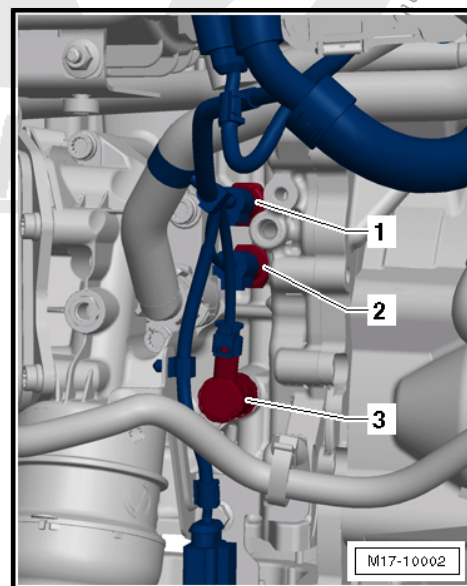
If the specification is not obtained:

- Check the oil intake pipe screen for contamination -item 25-
⇒ [Item 25 \(page 124\)](#) .
- Install the Reduced Oil Pressure Switch - F378- .

2.3.2 Oil Pressure, Checking, Vehicles with Engine Code CCCA

Special tools and workshop equipment required

- ◆ Oil Pressure Gauge Kit - VAG1342-
- ◆ Voltage Tester - VAG1527B-
- ◆ Connector Test Set - VAG1594A- or -VAG1594C-





- Engine oil level OK
- Engine oil temperature at least 80 °C (176 °F) (radiator fan must start up once).

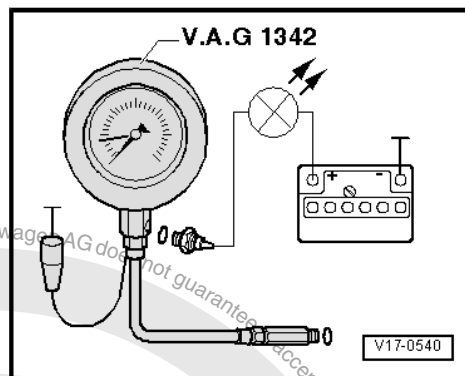


Note

Checking the function and servicing the optical and acoustic oil pressure display. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations and use Vehicle Diagnostic Tester "Guided Fault Finding" function; "Function and Component Selection".

- Remove the Oil Pressure Switch - F1- and install it in the tester.
- Thread the oil pressure gauge into the oil filter bracket in place of oil pressure switch.
- Connect the brown wire on the tester to the ground (-).
- Connect the Voltage Tester - VAS6839- to battery positive (+) and the oil pressure switch using adapter cables from the Connector Test Set - VAG1594D- .

- LED must not light up.
- If the LED lights up, replace the 1.4 bar (20.30 psi) Oil Pressure Switch - F1- .



If the LED does not light up:

- Start the engine and increase the RPM.
- The LED must light up at 1.2 to 1.6 bar (17.4 to 23.2 psi) pressure. If it does not, replace the oil pressure switch.
- Increase the RPM further.
- At higher engine speeds oil pressure must not exceed 7.0 bar (101.52 psi)
- At 2,000 RPM and an oil temperature of 80 °C (176 °F), the oil pressure must be 2.7 to 4.5 bar (39.16 to 65.26 psi).

If the specification is not obtained:

- Check the oil intake pipe screen for contamination -item 25-
⇒ [Item 25 \(page 124\)](#) .



Note

Also, mechanical damage, for example, bearing damage can also be the cause of too low oil pressure.

If no malfunction can be found:

- Replace the oil pump. Refer to
⇒ ["1.5 Oil Pump, Removing and Installing", page 129](#) .

If the specified value is exceeded:

- Check the oil channels.
- Replace oil filter bracket if necessary.

2.3.3 Oil Pressure Switch, Checking, Vehicles with Engine Codes CBTA, CBUA

Special tools and workshop equipment required

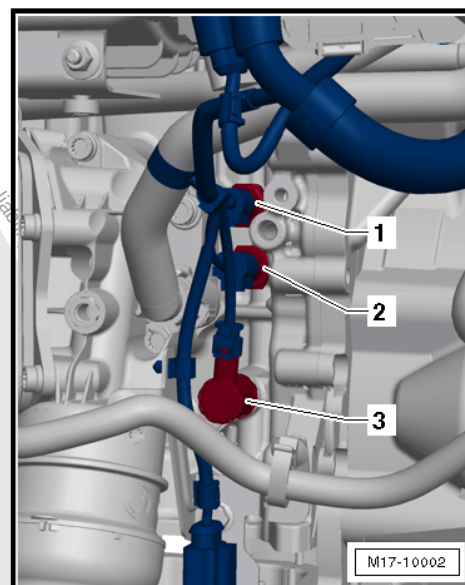
- ◆ Oil Pressure Gauge Kit - VAG1342-



- ◆ Voltage Tester VAS6839 - VAS6839-
- ◆ Connector Test Set - VAG1594D-
- ◆ Socket and Jointed Extension - 24mm - T40175-

Checking the Reduced Oil Pressure Switch - F378- (Brown):

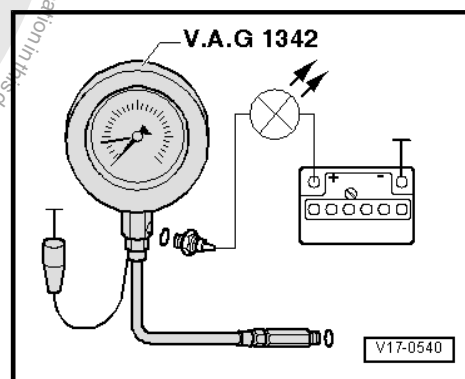
- Disconnect the connector -2- from the Reduced Oil Pressure Switch - F378- (brown).
- Remove the Reduced Oil Pressure Switch - F378- .
- Connect the Oil Pressure Gauge Kit - VAG1342- in the opening for the oil pressure switch.
- Install the Reduced Oil Pressure Switch - F378- in the oil pressure tester.



- Connect brown wire on the tester to the ground (-).
- Connect the Voltage Tester - VAS6839- with adapter cables from the Connector Test Set - VAG1594D- to the battery positive (+) and the Reduced Oil Pressure Switch - F378- (brown).
- LED must not light up.
- If the LED illuminates, replace the Reduced Oil Pressure Switch - F378- .

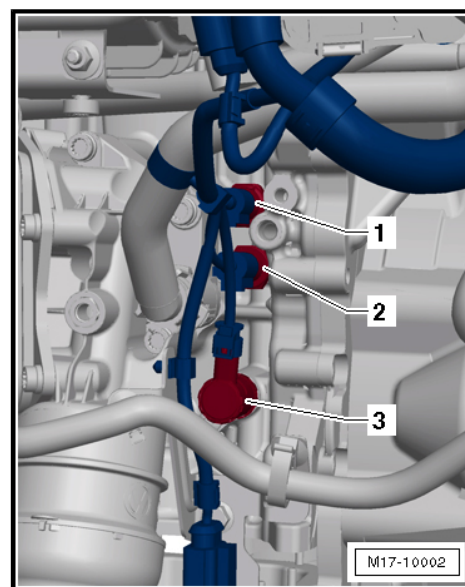
If the LED does not light up:

- Start the engine: the LED must come on at 0.55 to 0.85 bar (7.97 to 12.32 psi). If it does not, replace the oil pressure switch.



Oil Pressure Switch - F1- (Blue), Checking:

- Disconnect the connector -1- on the Oil Pressure Switch - F1- (blue).
- Remove the Oil Pressure Switch - F1- .
- Connect the Oil Pressure Gauge Kit - VAG1342- in the opening for the oil pressure switch.
- Install the Oil Pressure Switch - F1- in the oil pressure tester.





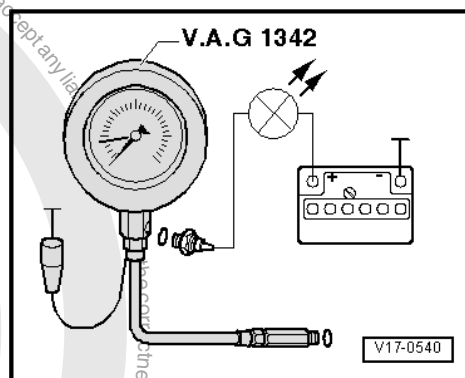
- Connect brown wire on the tester to the ground (-).
- Connect the Voltage Tester - VAS6839- to battery positive (+) and the Oil Pressure Switch - F1- (blue) using the adapter cables from the Connector Test Set - VAG1594D- .

• LED must not light up.

- If the LED goes out, replace the Oil Pressure Switch - F1- .

If the LED does not light up:

- Start the engine: the LED must come on at 2.15 to 2.95 bar (31.18 to 42.78 psi). If it does not, replace the oil pressure switch.



2.3.4 Oil Pressure Switch, Checking, Vehicles with Engine Code CCCA

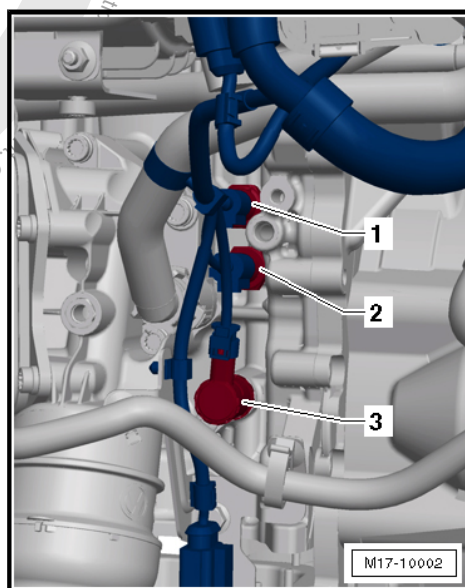
Oil Pressure Switch - F1- (Blue) Checking



Note

Ignore -2- and -3-:

- Disconnect the connector -1- on the Oil Pressure Switch - F1- (blue).
- Remove the Oil Pressure Switch - F1- .
- Connect the Oil Pressure Gauge Kit - VAG1342- in the opening for the oil pressure switch.
- Install the Oil Pressure Switch - F1- in the oil pressure tester.





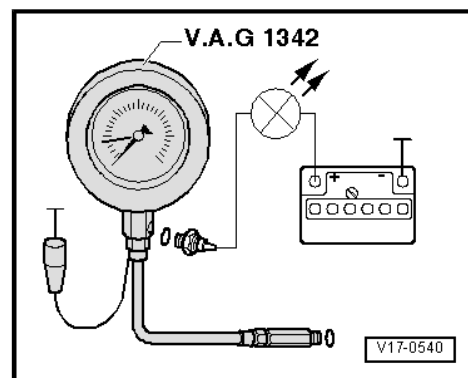
- Connect brown wire on the tester to the ground (-).
- Connect the Voltage Tester - VAS6839- to battery positive (+) and the Oil Pressure Switch - F1- (blue) using the adapter cables from the Connector Test Set - VAG1594D- .

• LED must not light up.

- If the LED goes out, replace the Oil Pressure Switch - F1- .

If the LED does not light up:

- Start the engine: the LED must come on at 2.15 to 2.95 bar (31.18 to 42.78 psi). If it does not, replace the oil pressure switch.



Installing

Install in reverse order of removal. Note the following:



Note

Always replace gasket and seals.

Tightening Specifications

- ◆ Refer to
 ⇒ ["2.1 Overview - Oil Filter Housing/Oil Pressure Switch", page 132](#)

2.4 Oil Filter Housing, Removing and Installing

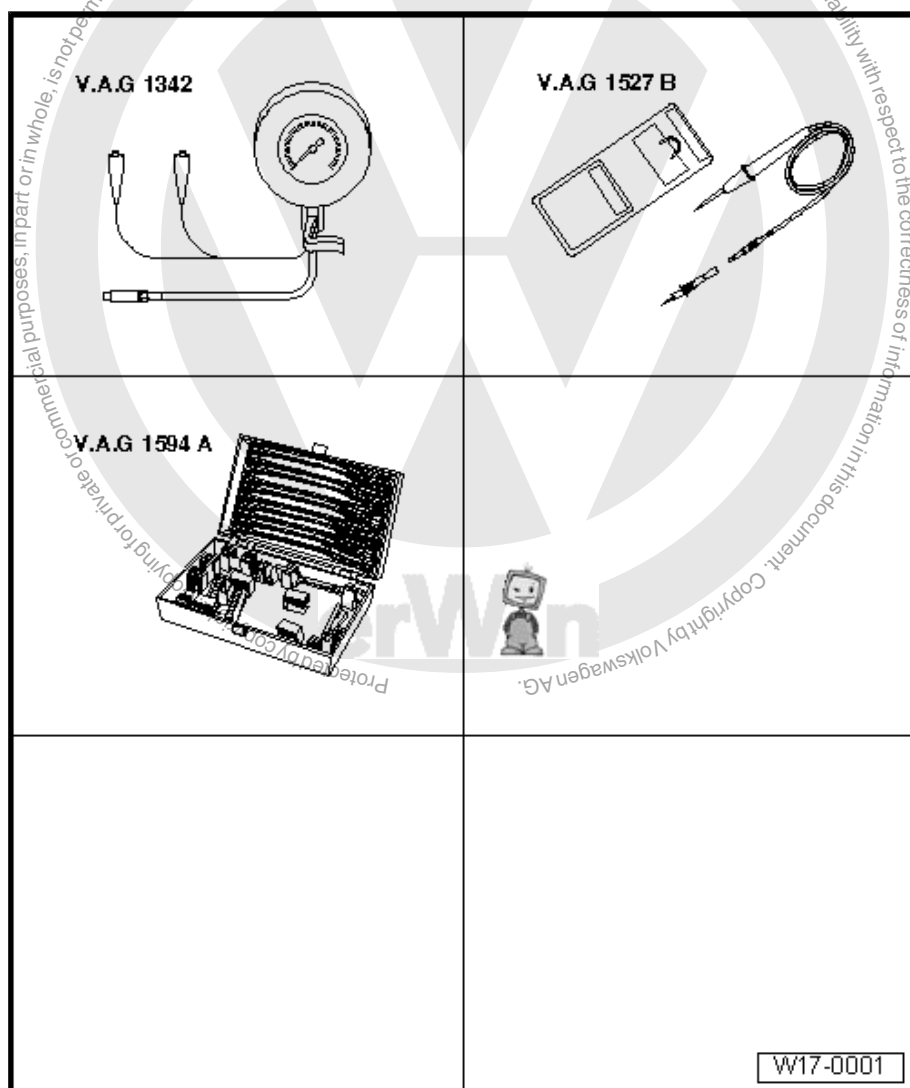
Removing

- Drain the coolant. Refer to
 ⇒ ["1.4 Coolant, Draining and Filling", page 147](#) .
- Remove the intake manifold. Refer to
 ⇒ ["4.3 Intake Manifold, Removing and Installing", page 189](#) .
- Remove the connection for the thermostat.
- Disconnect coolant hose from thermostat housing.
- Loosen intake manifold support.
- Remove the oil filter bracket. The bleeder hose remains connected -item 10- ⇒ [Item 10 \(page 133\)](#) .




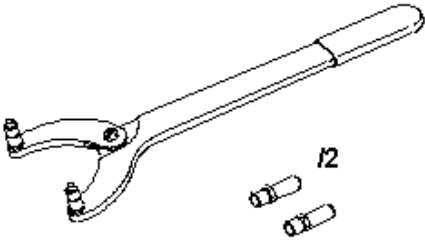
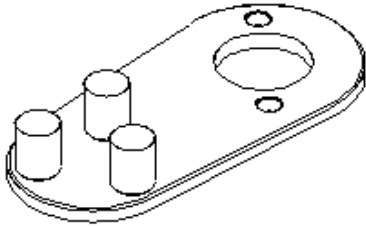
3 Special Tools

Special tools and workshop equipment required

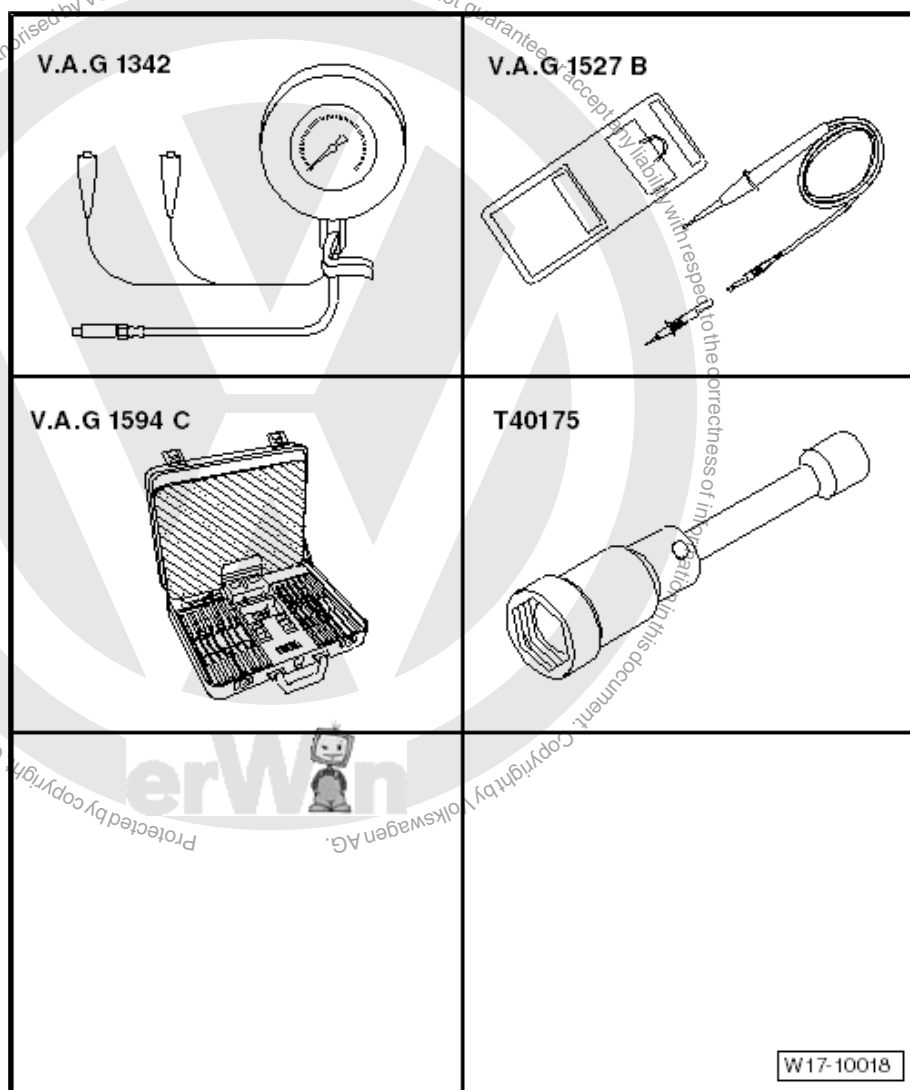


- ◆ Oil Pressure Gauge Kit - VAG1342-
- ◆ Voltage Tester - VAG1527B-
- ◆ Connector Test Set - VAG1594A- or -VAG1594C-

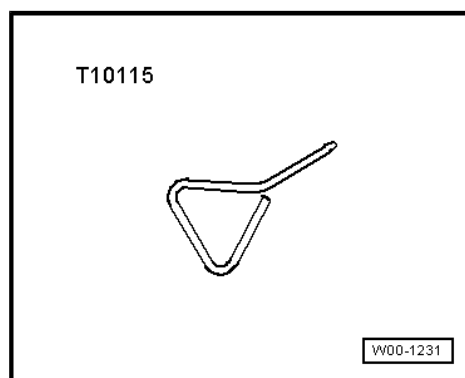


<p>V.A.G 1331</p> 	<p>T10172</p> 
<p>T03005</p> 	
	<p>W17-10005</p>

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Counterhold - Kit - Multiple Use - T10172-
- ◆ Oil Pump Alignment Plate - T03005-
- ◆ Oil Pump Shim T03005/1-

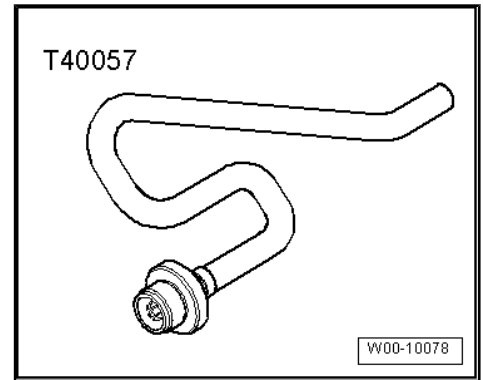


- ◆ Oil Pressure Gauge Kit - VAG1342-
- ◆ Voltage Tester VAS6839 - VAS6839-
- ◆ Connector Test Set - VAG1594D-
- ◆ Socket and Jointed Extension - 24mm - T40175-
- ◆ Locking Pin - T10115-

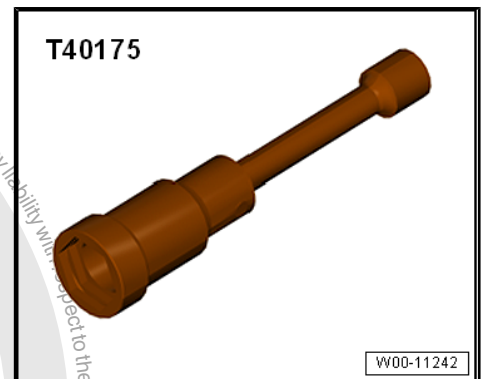




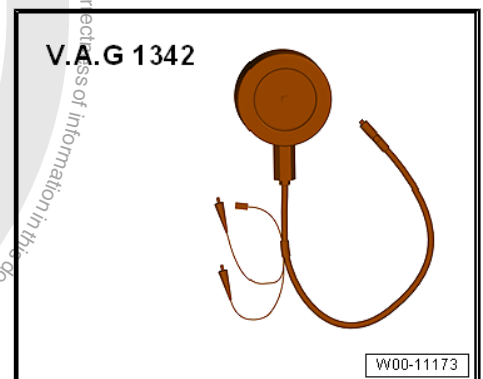
- ◆ Oil Drain Adapter - T40057-



- ◆ Socket and Jointed Extension - 24mm - T40175-



- ◆ Oil Pressure Gauge Kit - VAG1342-



- ◆ Hand drill with plastic brush attachment
- ◆ Protective eyewear
- ◆ Silicone Sealant - D 174 003 A2-



19 – Cooling System

1 Coolant System/Coolant

⇒ [“1.1 Connection Diagram - Coolant Hoses”, page 144](#)

⇒ [“1.2 Overview - Engine Pre-Warmer”, page 146](#)

⇒ [“1.3 Coolant System, Checking for Leaks”, page 146](#)

⇒ [“1.4 Coolant, Draining and Filling”, page 147](#)

1.1 Connection Diagram - Coolant Hoses



Note

Arrows on coolant pipes and coolant hoses must line up across from each other.

1 - Radiator

- ☐ Removing and Installing. Refer to
⇒ [“3.2 Radiator, Removing and Installing”, page 167](#).
- ☐ Replace the coolant after replacing the heater core.

2 - Coolant Pipe

3 - Intake Manifold

4 - Coolant Pump and Coolant Thermostat

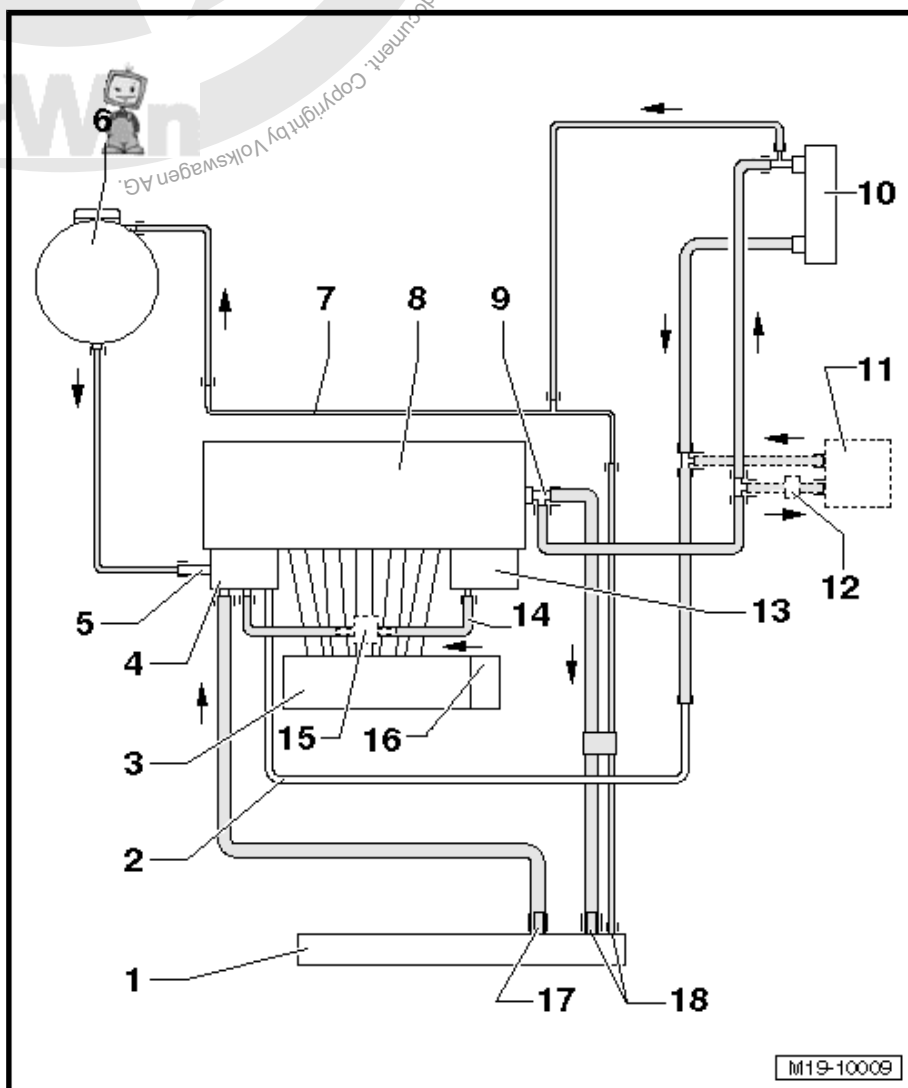
- ☐ Coolant Pump, Removing and Installing. Refer to
⇒ [“2.2 Coolant Pump, Removing and Installing”, page 157](#).
- ☐ Coolant thermostat, removing and installing. Refer to
⇒ [“2.3 Coolant Thermostat, Removing and Installing”, page 164](#).
- ☐ Checking coolant regulator. Refer to -item 17-
⇒ [Item 17 \(page 154\)](#).

5 - Front Coolant Pipe

- ☐ Secured to bracket for assemblies

6 - Expansion Tank

- ☐ With cap
- ☐ Pressure relief valve inside cap, checking. Refer to
⇒ [“1.3 Coolant System, Checking for Leaks”, page 146](#).





7 - Rear Coolant Pipe

8 - Cylinder Head/Cylinder Block

- ☐ Replace the coolant after replacing the heater core.

9 - Coolant Distribution Housing

10 - Heater Core

- ☐ Replace the coolant after replacing the heater core.

11 - Transmission Fluid Cooler

- ☐ Only for vehicles with an automatic transmission

12 - Bypass Thermostat

- ☐ Only for vehicles with an automatic transmission
- ☐ Overview. Refer to ⇒ [Fig. ""By-Pass Thermostat Assembly Overview""](#) , page 157 .
- ☐ Checking. Refer to ⇒ [page 157](#) .

13 - Engine Oil Cooler

14 - Coolant Hose

Two versions:

- ☐ Without an engine preheater
- ☐ With an engine preheater

15 - Preheater

- ☐ Only on vehicles with an engine preheater

16 - Throttle Valve Control Module - J338-

- ☐ The throttle valve control module heated by the coolant has been discontinued.

17 - Lower Radiator Connection

18 - Upper Radiator Connection



1.2 Overview - Engine Pre-Warmer

Not all vehicles have a pre-heater.

1 - Guide Tube

- ☐ For the oil dipstick

2 - Left Cover

- ☐ Inside the front bumper cover

3 - Bracket

4 - Connecting Cable

- ☐ Make sure it is attached securely

5 - Locking Mechanism

6 - From the Oil Cooler

- ☐ -Item 12-
⇒ [Item 2 \(page 154\)](#)

7 - Preheater

8 - To coolant Regulator Housing

- ☐ -Item 20-
⇒ [Item 20 \(page 155\)](#)

9 - Bolt

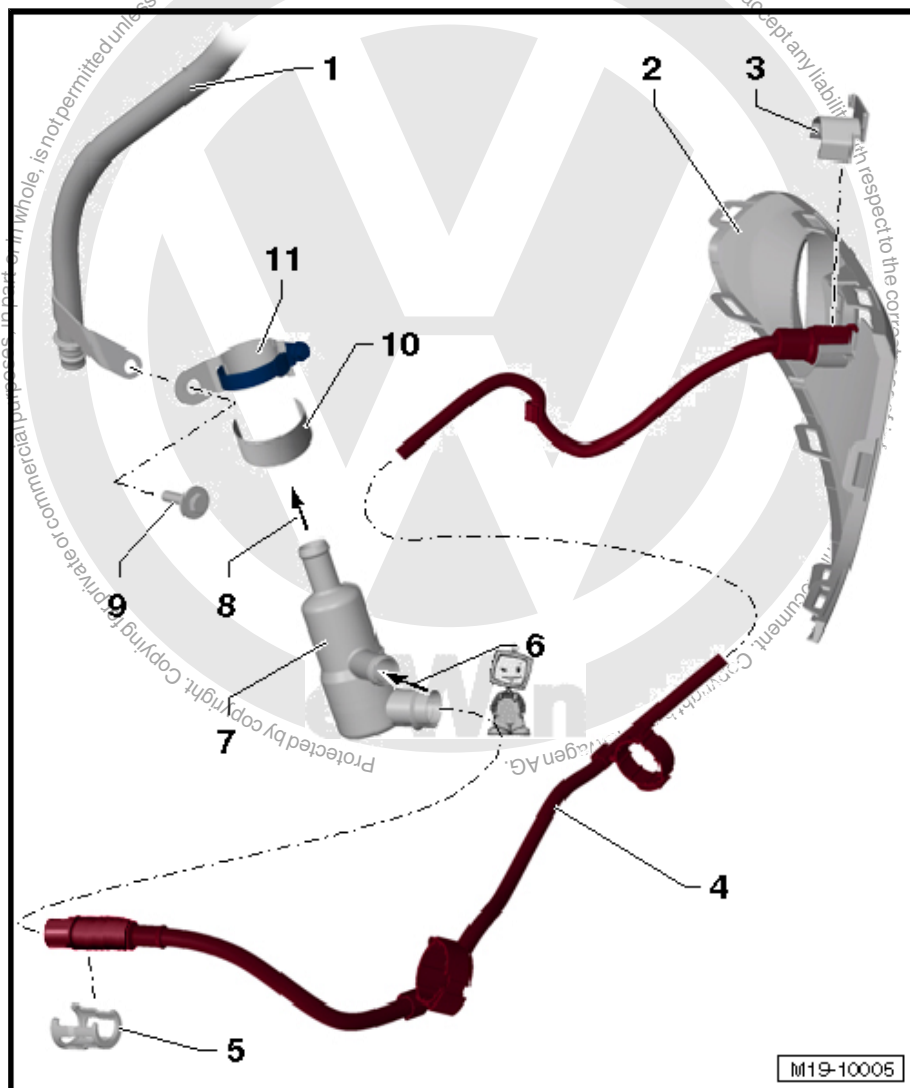
- ☐ 25 Nm

10 - Adhesive Foil

- ☐ Attached on the pre-heater near screw-type clamp to prevent corrosion on the contacts

11 - Bracket with Screw-Type Clamp

- ☐ Tighten the screw-type clamp to 3 Nm.



1.3 Coolant System, Checking for Leaks

Special tools and workshop equipment required

- ◆ Cooling System Tester - VAG1274B-
- ◆ Cooling System Tester - Adapter - VAG1274/8-
- ◆ Cooling System Tester - Adapter - VAG1274/9-

Test Conditions

- Engine at operating temperature.



Test Sequence



WARNING

The coolant system is under pressure when the engine is warm.

Risk of scalding due to hot steam and hot coolant.

Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.

- Open the coolant expansion tank cap.
- Install the Cooling System Tester - Adapter - VAG1274/8- into the coolant expansion tank.
- Clamp the Cooling System Tester - Adapter - VAG1274B/1- in the Cooling System Tester - Adapter - VAG1274/8-.
- Connect the Cooling System Tester - Adapter - VAG1274B/1- to the Cooling System Tester - VAG1274B- using the hose provided.
- Generate a positive pressure of approximately 1.0 bar (14.5 psi) using hand pump of cooling system tester.

If the pressure drops:

- Search for leaking areas and repair the malfunction.

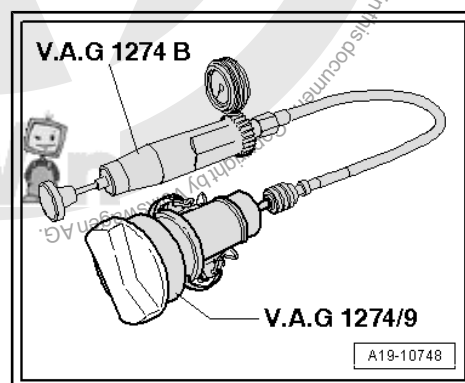
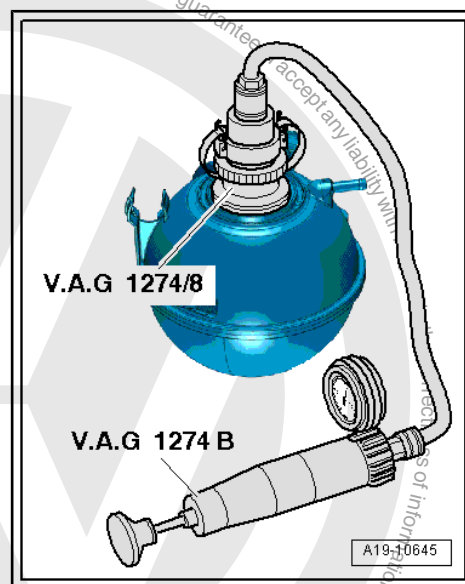
Pressure Relief Valve in Cap, Checking

- Install the cap in the Cooling System Tester - Adapter - VAG1274/9- .
- Clamp the Cooling System Tester - Adapter - VAG1274B/1- in the Cooling System Tester - Adapter - VAG1274/9- .

- Connect the Cooling System Tester - Adapter - VAG1274B/1- to the Cooling System Tester - VAG1274B- using the hose provided.
- Operate the hand pump.
- The pressure release valve must open at 1.4 to 1.6 bar (20.30 to 23.20 psi).

If the pressure relief valve opens too early or too late:

- Replace the cap.



1.4 Coolant, Draining and Filling

Special tools and workshop equipment required

- ◆ Refractometer - T10007A-
- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Hose Clip Pliers - VAS6340-
- ◆ Cooling System Charge Kit - VAS6096-



- ◆ Cooling System Tester - Adapter - VAG1274/8-
- ◆ Protective eyewear
- ◆ Safety Gloves

Draining



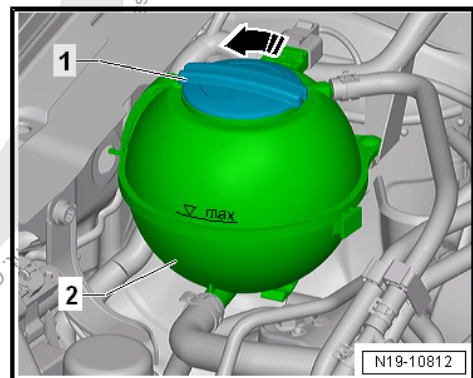
WARNING

The coolant system is under pressure when the engine is warm.

Risk of scalding due to hot steam and hot coolant.

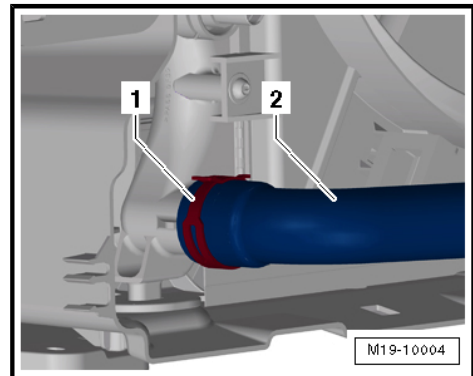
Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.

- Carefully open the fuel cap -1- on the coolant reservoir -2- in direction of -arrow-.
- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Place the Drip Tray under the radiator.



- Open the spring clamp -1- and remove the coolant hose -2-.

Filling



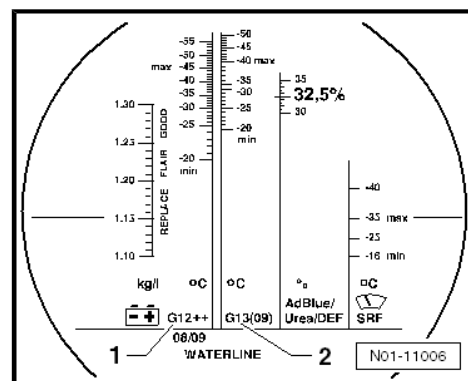


Note

- ◆ The water portion of the coolant greatly influences the effectiveness of the coolant. The water quality to be used is based on the contents, which can be specific to a country or even a region. Distilled water fulfills all requirements. For this reason, use distilled water when adding coolant or filling coolant for the first time.
- ◆ Use only coolant additives listed. Refer to the Vehicle Diagnostic Tester. Other coolant additives may above all reduce the corrosion protection effect significantly. The damage resulting from this may lead to loss of coolant and consequently to severe engine damage.
- ◆ Coolant with the correct mixture ratio prevents freezing and corrosion damage and calcium deposits. Additionally, the boiling point will be raised. For this reason the cooling system must be filled with coolant additive year-round.
- ◆ Because of its high boiling point, the coolant contributes to engine reliability under heavy engine loads, particularly in countries with tropical climates.
- ◆ The Refractometer - T10007A- MUST be used to determine the freeze protection value.
- ◆ Protection against frost must be assured down to minimum -25 °C (-13 °F) (in arctic climatic countries down to approximately -36 °C (-32.8 °F)). The freeze protection may only be increased, when stronger freeze protection is needed due to the climate, the freeze protection may be increased. But only down to -48 °C (-54 °F), otherwise the effectiveness of the coolant decreases.
- ◆ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The frost protection must be at least -25 °C (-13 °F).
- ◆ Read the freeze protection value on the scale for the coolant additive that has been added.
- ◆ The temperature on the Refractometer - T10007A- corresponds to the »freezing point«. At this temperature, ice crystals may begin to form in the coolant.
- ◆ Do not reuse used coolant.
- ◆ Only use water/coolant additive to lubricate the coolant hoses.

Coolant Mixture Ratio

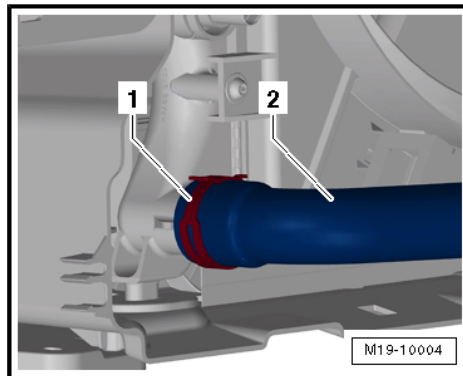
- Coolant (40%) and distilled water (60%) for freeze protection down to -25 °C (-13 °F)
- Coolant (50%) and distilled water (50%) for freeze protection down to -36 °C (-32.8 °F)
- Coolant. Refer to the Parts Catalog.





- Connect the coolant hose -2- to the radiator and secure it with a spring clamp -1-.

Filling with Cooling System Charge Kit - VAS6096-



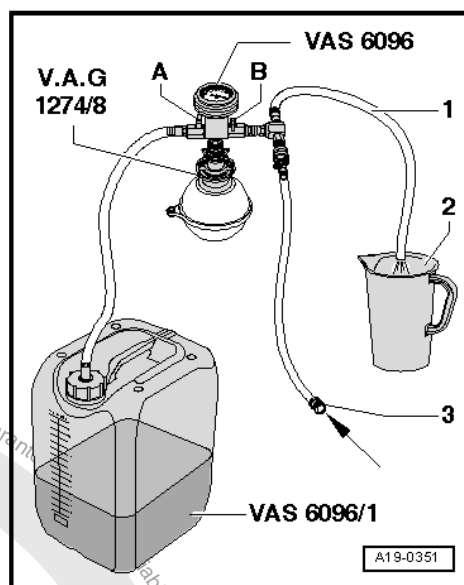
- Fill the Cooling System Charge Kit - Reservoir - VAS6096/1- on the Cooling System Charge Kit - VAS6096- with at least 10 liters (10.56 quarts) of coolant.
- Use the proper mixture ratio of coolant.
- Install the Cooling System Tester - Adapter - VAG1274/8- on the coolant expansion tank.
- Mount the Cooling System Charge Kit - VAS6096- on the Cooling System Tester - Adapter -VAG1274/8- .
- Place the air outlet hose -1- in a small container -2-.



Note

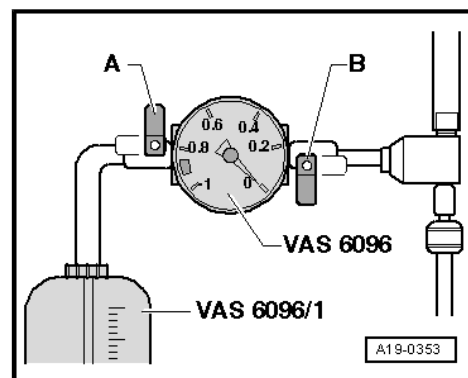
A small amount of coolant which should be collected is drawn off with the discharged air.

- Close valves -A- and -B- by turning lever at a right angle to direction of flow.
- Connect the hose -3- to compressed air.
- Pressure: 6 to 10 bar (87 to 145 psi) positive pressure.





- Open valve -B- by turning level in direction of flow.
- A further vacuum is created in the cooling system by the suction jet pump.
- Needle on the instrument display must travel into the green region.
- Open the valve -A- slightly for a moment.
- To do this, turn the lever in the flow direction so that the Cooling System Charge Kit - Reservoir - VAS6096/1- hose fills with coolant.
- Close valve -A- again.
- Leave valve -B- open another two minutes.
- A further vacuum is created in the cooling system by the suction jet pump.
- Needle on the instrument display must still remain in the green region.
- Close valve -B-.
- The needle on display must remain in the green range.
- Only then is there enough vacuum in the coolant system for the filling.



Note

- ◆ Repeat the procedure if the needle goes below the green range.
- ◆ Check the cooling system for leak if the pressure drops.
- Remove pressurized air hose.
- Open valve -A-.
- The vacuum in the cooling system causes coolant to be extracted from the Cooling System Charge Kit - Reservoir - VAS6096/1- and to fill the cooling system.
- Remove the Cooling System Charge Kit - VAS6096- from the coolant reservoir.



- Fill the coolant expansion tank -1- with coolant to the “Max” marking -arrow-.
- Install the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Overview - Noise Insulation .
- If the vehicle has a parking heater, switch it on for about 30 seconds.
- Set the temperature at “HI”.
- Press **AC** to turn off the A/C compressor.
 - The LED in the button must not come on.
- Start the engine and run it at approximately 1500 RPM for a maximum of two minutes.
- With engine running, fill coolant up to overflow hole on coolant expansion tank.
- Close the cap on the coolant reservoir until it locks into place.
- Allow engine to run at idle until both large coolant hoses on the radiator are warm.
- Turn off engine and allow it to cool off.
- Check the coolant level in the coolant reservoir -1-.
- The coolant level must be between the “min” and “max” markings when the engine is cold.
- The coolant level may be at the “max” marking -arrow- when the engine is warm.
- Add more coolant if necessary.

Filling Without Cooling System Charge Kit - VAS6096-

- Slowly add coolant until it reaches the upper marking -arrow- on the reservoir.
- Close the reservoir.
- Turn off the heater and A/C.
- Start the engine and maintain an engine speed of approximately 2000 RPM for about 3 minutes.
- Let engine run until fan starts up.

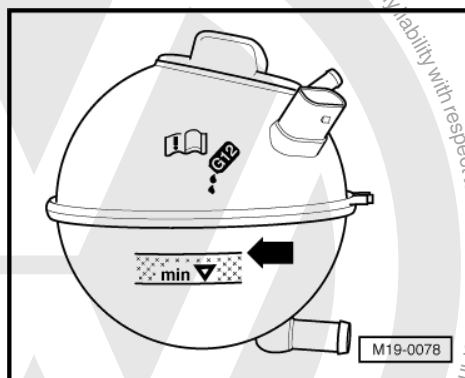
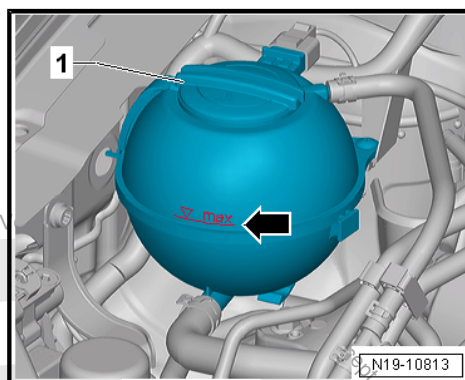
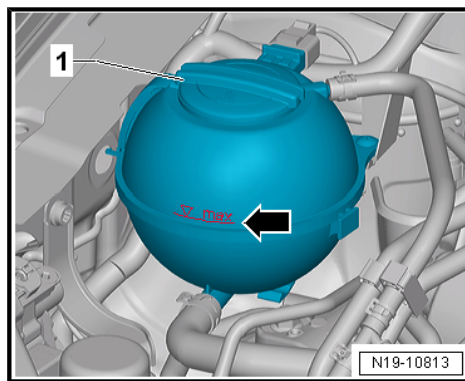


WARNING

The coolant system is under pressure when the engine is warm.

Risk of scalding due to hot steam and hot coolant.

Reduce pressure by covering coolant reservoir cap with a cloth and carefully opening.

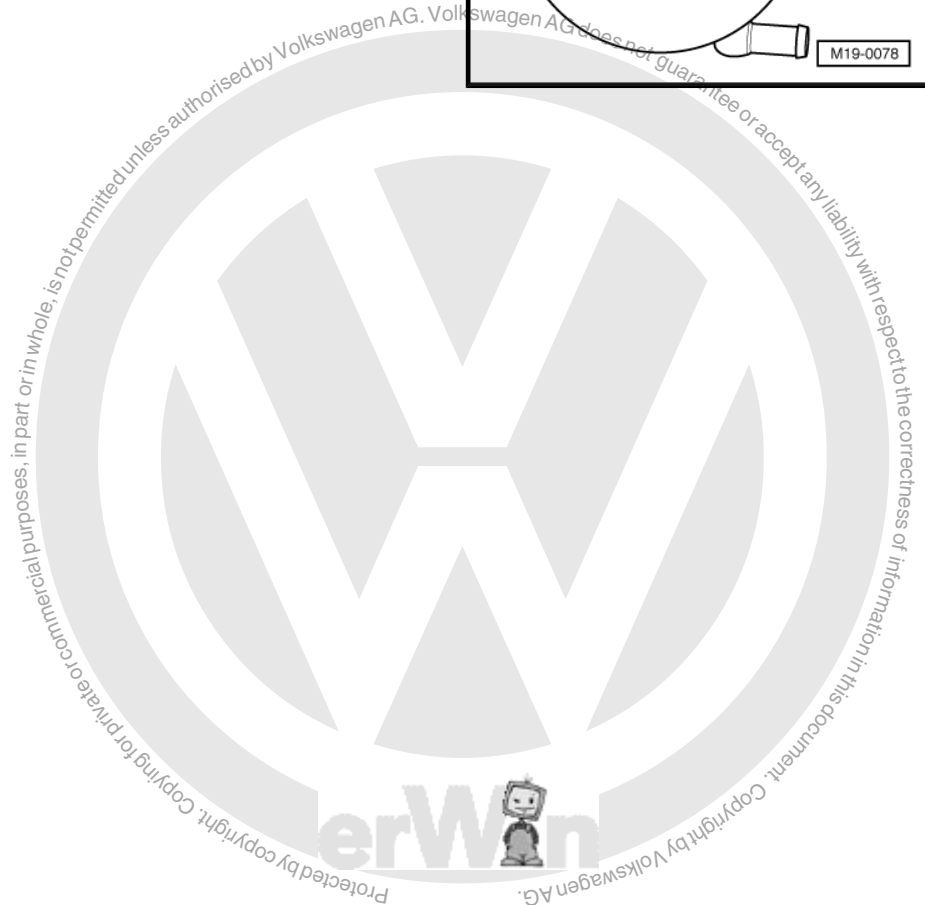
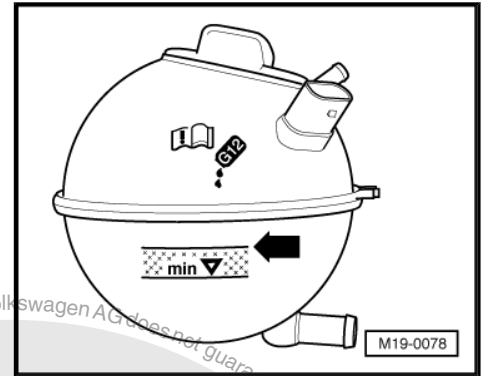


- Check the coolant level with the reservoir closed. If more coolant is needed, let the engine cool down and then add.





- At engine operating temperature, the coolant level must be at the upper marking in the shaded area -arrow-.
- When the engine is cold, the coolant level should be in the middle of the shaded area.





2 Coolant Pump/Thermostat

⇒ [“2.1 Overview - Coolant Pump/Thermostat”, page 154](#)

⇒ [“2.2 Coolant Pump, Removing and Installing”, page 157](#)

⇒ [“2.3 Coolant Thermostat, Removing and Installing”, page 164](#)

2.1 Overview - Coolant Pump/Thermostat

Part 1 Belt Pulley Side

1 - Cylinder Block

2 - Engine Oil Cooler

3 - Bolt

□ 25 Nm

4 - Bolt

□ 10 Nm

5 - To Heater Core of Heater, Bottom

6 - Guide Tube

□ For the oil dipstick

7 - Preheater

□ Only vehicles with engine preheater

8 - Bolt

□ 25 Nm

9 - O-Ring

□ Replace after removing

10 - Clamp

□ Make sure it is secure

11 - Front Coolant Pipe

12 - Connecting Hose

13 - Connection

14 - To Lower Radiator

15 - Bolt

□ 5 Nm

16 - O-Ring

□ Replace after removing

17 - Coolant Thermostat

□ Removing and Installing. Refer to ⇒ [“2.3 Coolant Thermostat, Removing and Installing”, page 164](#) .

□ Note installation position:

Valve must be at top

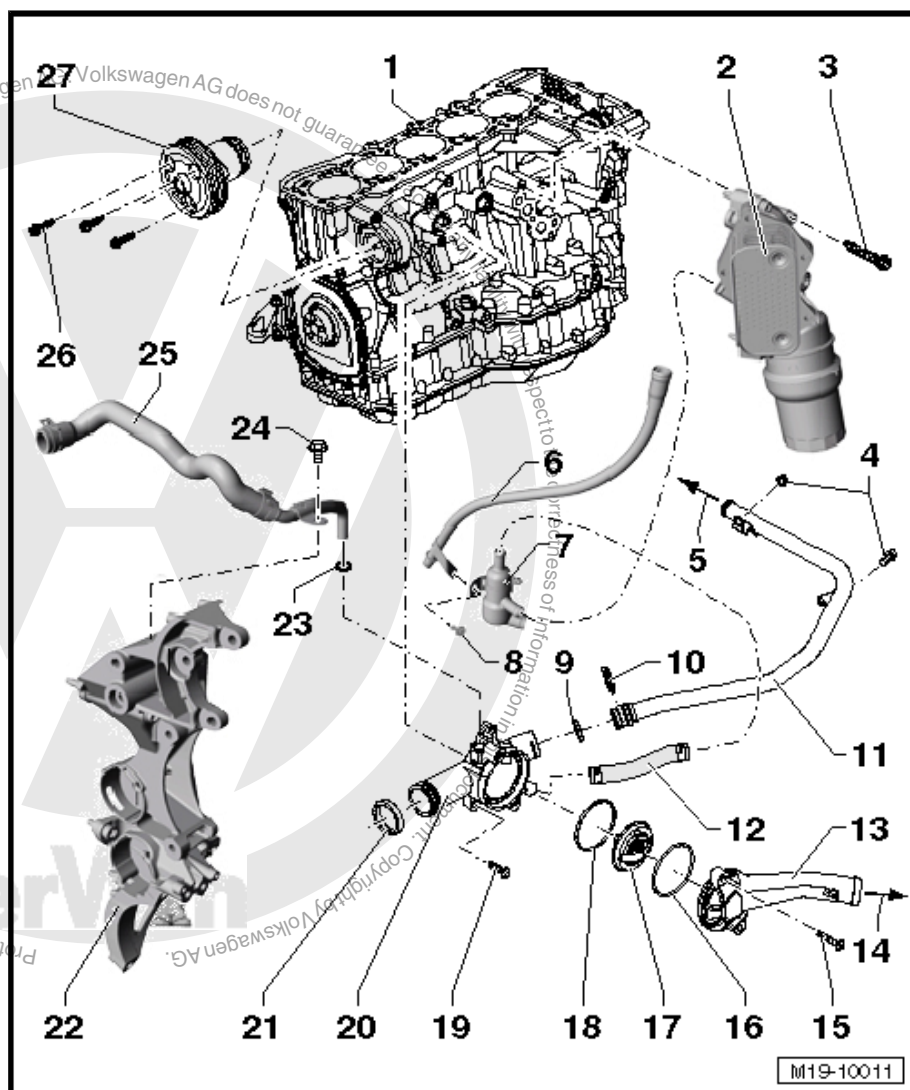
□ checking (coolant thermostat installed):

Refer to the Vehicle Diagnostic Tester “Guided Fault Finding” “Guided Functions”

□ checking (coolant thermostat removed):

Heat up thermostat in water.

Opens at: approximately 87 °C (188.6 °F)
and stops at: approximately 102 °C (215.6 °F)





opening travel: minimum 7 mm

18 - Seal

- ☐ Replace after removing

19 - Bolt

- ☐ 25 Nm

20 - Coolant Thermostat Housing

21 - Seal

- ☐ Replace after removing

22 - Sub-Assembly Bracket

23 - O-Ring

- ☐ Replace after removing

24 - Bolt

- ☐ 9 Nm

25 - Coolant Hose

- ☐ To the front coolant pipe
- ☐ To the bottom of the reservoir

26 - Bolt

- ☐ 10 Nm

27 - Coolant Pump

- ☐ With integrated silicone seal for sealing the cylinder block
- ☐ Removing and Installing. Refer to ["2.2 Coolant Pump, Removing and Installing", page 157](#) .

Part 2 Transmission Side



1 - Coolant Connection

- ☐ Pressed in cylinder head
- ☐ Clean before installing the coolant distribution housing -item 18-
⇒ [Item 18 \(page 157\)](#)
- If necessary, remove coolant deposits with a brass wire brush or with a fine sandpaper (minimum 100 grit).
- ☐ If the pipe connection is worn, replace it using Locking Fluid: D 000600 A2- .

2 - Circlip

3 - Seal

- ☐ After removing the coolant distribution housing. Refer to
⇒ ["2.3 Coolant Thermostat, Removing and Installing", page 164](#) .

4 - To Expansion Tank, Top

5 - Rear Coolant Pipe

6 - Bracket

- ☐ For Heated Oxygen Sensor - G39-

7 - Bolt

- ☐ 10 Nm

8 - Heat Shield

9 - To Heater Core, Top

10 - Supply Hose

11 - Bypass Thermostat

- ☐ Only for vehicles with an automatic transmission
- ☐ Overview. Refer to ⇒ [Fig. "By-Pass Thermostat Assembly Overview", page 157](#) .
- ☐ Checking. Refer to ⇒ [page 157](#) .

12 - To the Transmission Fluid Cooler

- ☐ Only for vehicles with an automatic transmission

13 - From Heater Core, Bottom

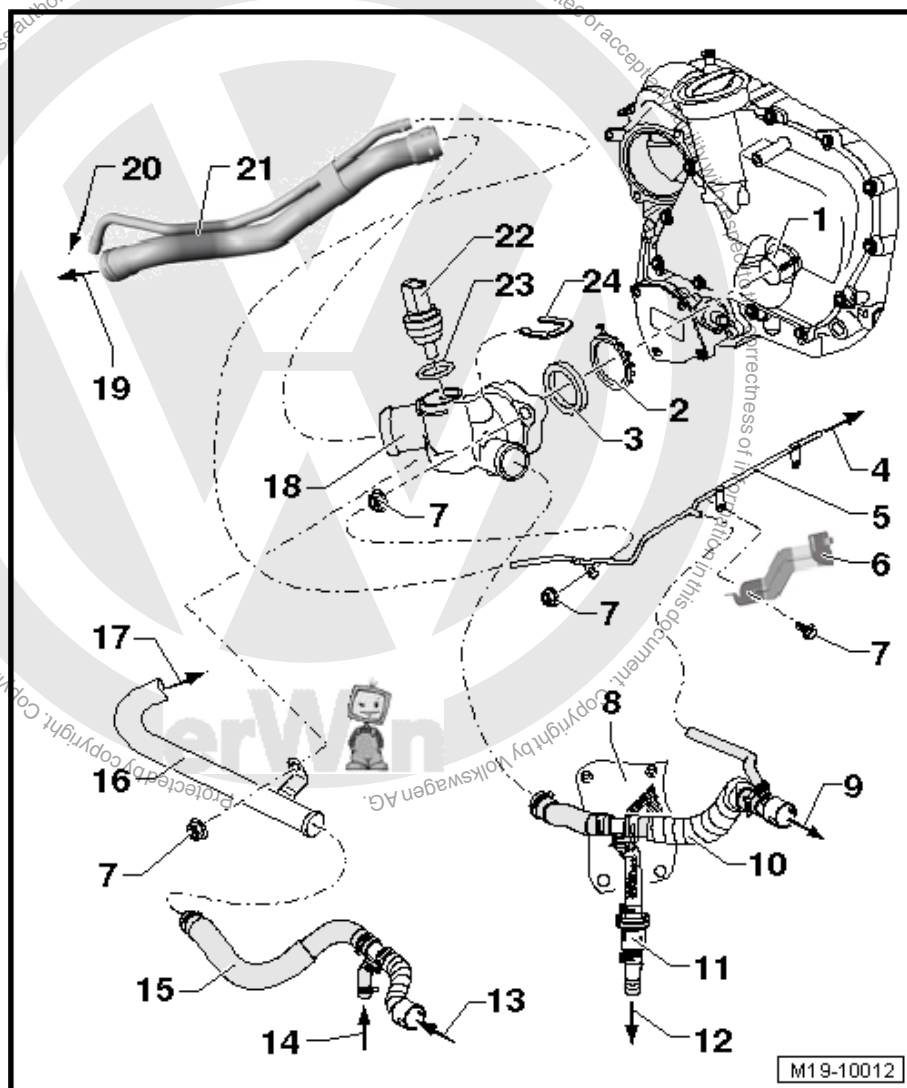
14 - From Transmission Oil Cooler

- ☐ Only for vehicles with an automatic transmission

15 - Return Hose

16 - Coolant Pipe

- ☐ Bolted to coolant regulator housing -item 18- ⇒ [Item 18 \(page 157\)](#)

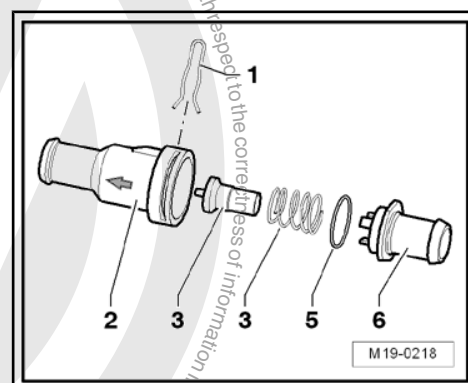




- 17 - To Coolant Regulator Housing
- 18 - Coolant Distribution Housing
- 19 - To the Top of the Radiator
- 20 - To the Top of the Radiator
- 21 - Supply Hose
- 22 - Engine Coolant Temperature Sensor - G62-
- 23 - O-Ring
 - ☐ Replace after removing
- 24 - Clamp
 - ☐ Make sure it is secure

By-Pass Thermostat Assembly Overview

- 1 - Spring Bracket
- 2 - Housing Lower Section
 - Pay attention to the installed position: the arrow points to the ATF cooler
- 3 - Operating Element
- 4 - Spring
- 5 - O-Ring
- 6 - Housing Upper Section



Checking Bypass Thermostat

- Remove the operating element -3- and warm it up in hot water.
 - Opening begins: approximately 75 °C (167 °F)
 - Opening ends: approximately 85 °C (185 °F)
 - Opening lift: approximately 5 mm



2.2 Coolant Pump, Removing and Installing

Special tools and workshop equipment required

- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support - Automatic Transmission Hook - 10-222A/7-
- ◆ Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2-
- ◆ From the Engine Support - Basic Set - T40091-
- ◆ Engine Support - Supplement Kit Mount 5 - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-



Procedure



Caution

Note the following whenever working inside the engine compartment due to limited space:

- ◆ **Route all lines and cables in their original locations.**
- ◆ **Make sure that there is sufficient clearance to all moving or hot components.**

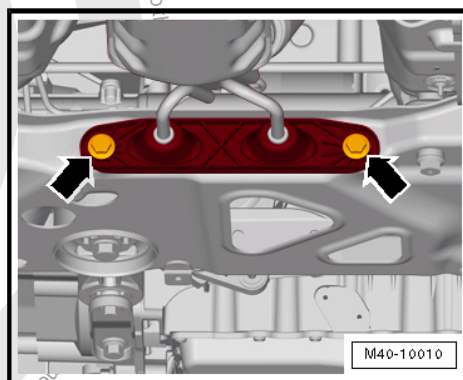


Caution

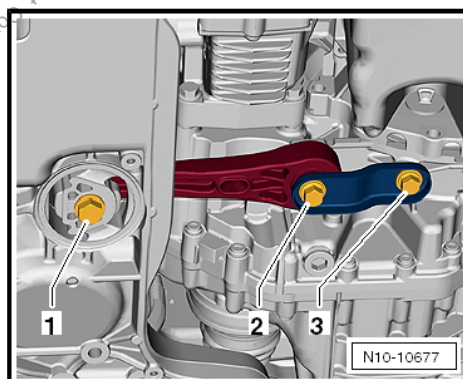
Danger of causing damage to the decoupling element.

- ◆ **Do not bend the decoupling element more than 10°.**
- ◆ **Do not stretch the decoupling element.**
- ◆ **Do not damage the wire mesh on the decoupling element.**

- Remove the noise insulation. Refer to ➤ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Remove the exhaust system bracket from the subframe -arrows-.



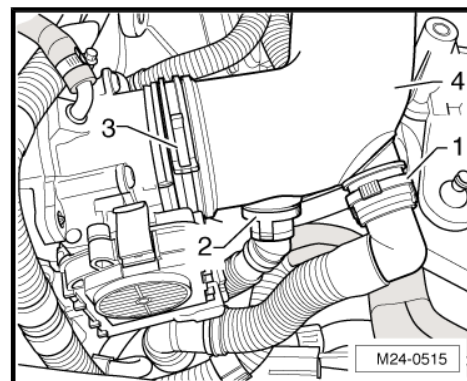
- Remove the bolt -1-.
- Remove the bolts -2- and -3-.
- Remove the pendulum support.
- Remove the air filter housing (engine cover). Refer to ➤ ["3.2 Air Filter Housing, Removing and Installing"](#), [page 186](#) .





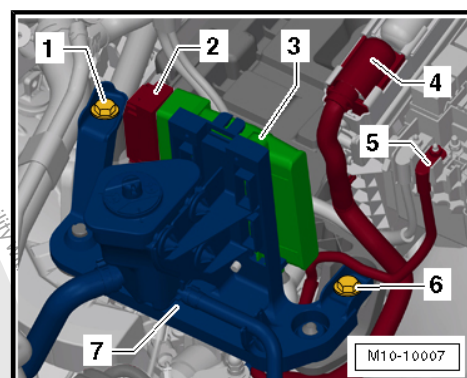
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.

Vehicles with an Automatic Transmission



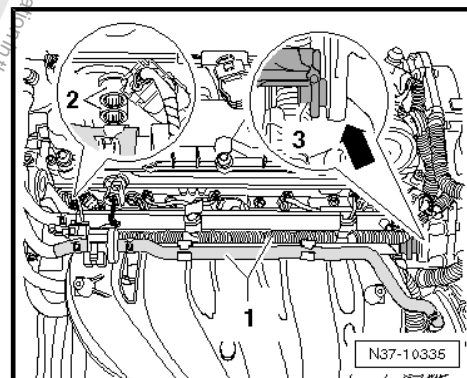
- Unclip the Transmission Control Module - J217- -3- from the bracket -7- and remove it.
- Disconnect the connector -2- from the Transmission Control Module - J217- .
- Remove the bolts -1- and -6-.
- Move the bracket -7- with the power steering fluid reservoir to the side. Be careful of the electric wires -4- and -5-.

The hoses remain connected to the power steering fluid reservoir.

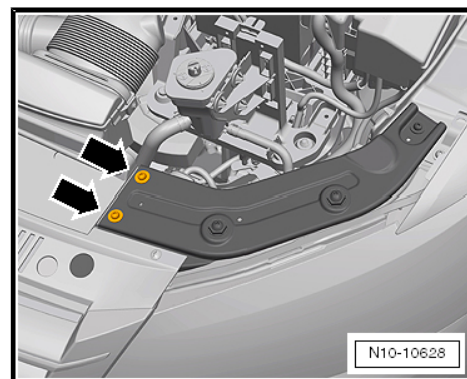


Continuation for All Vehicles

- Remove the battery and the battery tray. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- Remove the plenum chamber cover. Refer to ⇒ Body Exterior; Rep. Gr. 50 ; Bulkhead; Plenum Chamber Cover, Removing and Installing .
- Remove the wires -1- from the transport strap -3-.
- Remove the transport strap -3- from the engine -2- and pull it out of the eye -arrow-.
- Insert a Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12- in this eye.

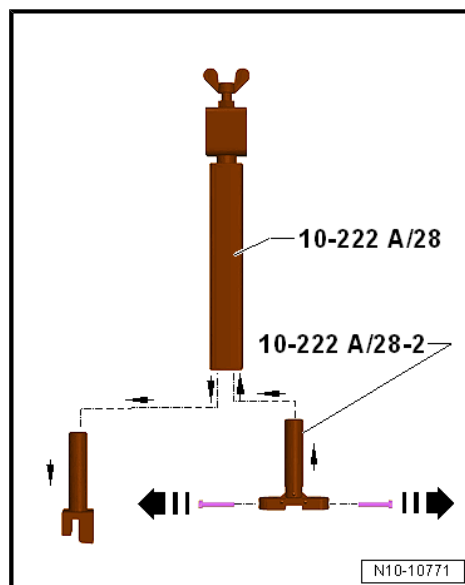


- Remove the bolts -arrows- from the left and right sides of the lock carrier bracket.





- Remove the lower mounts on the Engine Support Bridge - Engine Support 28 - 10-222A/28- and replace with the Engine Support 28-2 - 10-222A/28-2 .
- Remove the bolts -arrows- for securing the engine support bridge on the lock carrier from the Engine Support 28-2 - 10-222A/28-2 .

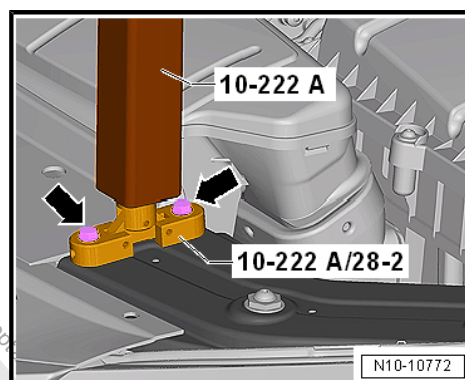


- Use the bolts from the Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2- for attaching the Engine Support Bridge - Engine Support 28 - 10-222A/28- . Do not use the bolts for the bracket.
- Bolt tightening specification -arrows-: 8 Nm



Caution

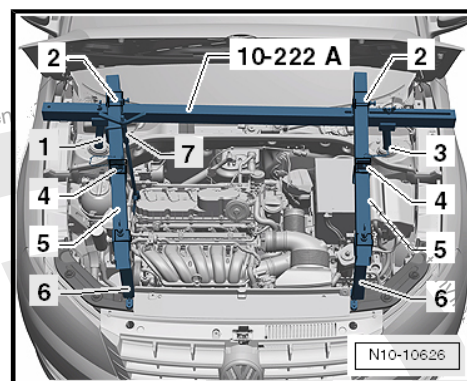
A second technician is needed when positioning the Engine Support Bridge - 10-222A- on the vehicle to keep the Engine Support Bridge from tipping.





Mount the engine support bridge on the engine/transmission sub-assembly as follows:

- 1 - Engine Support Bridge - Engine Support 31 Adapter 31-2 - 10-222A/31-2-
 - 2 - Engine Support - Basic Set - Moveable Joint - T40091/3-
 - 3 - Engine Support Bridge - Engine Support 31 Adapter 31-1 - 10-222A/31-1-
 - 4 - Movable Joint - T40093/4-
 - 5 - Engine Support - Basic Set - Square Pipe - T40091/1-
 - 6 - Engine Support Bridge - Engine Support 28 - 10-222A/28- with Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2-
 - 7 - Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- First slide the Movable Joints item - 2- onto the Square Pipe on the Engine Support Bridge - 10-222A- .
 - The bolts for the Movable Joints - T40091/3- item - 2- on the Engine Support Bridge - 10-222A- point in the direction of travel.
 - Mount the Engine Support Bridge - 10-222A- on the suspension strut domes and have a second technician hold it to prevent it from falling over.
 - Slide the Square Pipe - T40091/1- item - 5- on the left and right sides through the Engine Support Bridge - Engine Support 28 - 10-222A/28- item - 6- from the front and position the Moveable Joints - T40093/4- item - 4- on each side.
 - Additionally insert the Engine Support - Bracket w/Spindle and Hook - 10-222A/10- item - 7- on the right Engine Support - Basic Set - Square Pipe - T40091/1- .





- Slide the Rail with Holes - T40091/2- item- 9- with the Support - Supplement Kit - Mount - T40093/5- item - 10- into the Moveable Joints - T40093/4- item - 4-.

- 1 - Engine Support Bridge - Engine Support 31 Adapter 31-2 - 10-222A/31-2-
- 2 - Engine Support - Basic Set - Moveable Joint - T40091/3-
- 3 - Engine Support Bridge - Engine Support 31 Adapter 31-1 - 10-222A/31-1-
- 4 - Movable Joint - T40093/4-
- 5 - Engine Support - Basic Set - Square Pipe - T40091/1-
- 6 - Engine Support Bridge - Engine Support 28 - 10-222A/28- with Engine Support Bridge - Engine Support 28-2 - 10-222A/28-2-
- 7 - Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- 8 - Engine Support - Automatic Transmission Hook - 10-222A/7-
- 9 - Rail with Holes - T40091/2-
- 10 - Mount - T40093/5-
- 11 - Engine Support Bridge - Spindle - 10-222A/11-
- 12 - Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12-

- Insert the securing pin into the Rail with Holes - T40091/2- item - 9- and secure it with cotter pins.

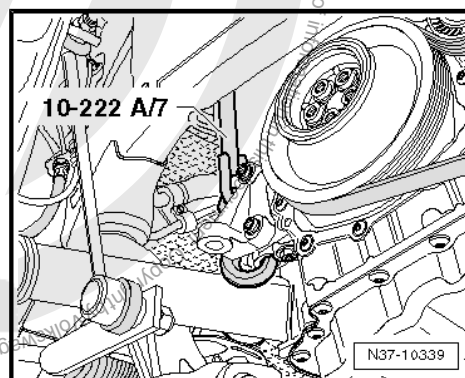
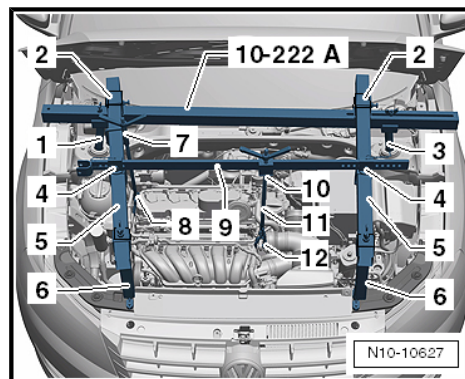
- Tighten all threaded connections on the Engine Support Bridge hand-tight. While doing so, adjust the height of the Engine Support Bridge parallel over the Engine Support Bridge - Engine Support 28 - 10-222A/28- .

- Extend the right Engine Support - Bracket w/Spindle and Hook - 10-222A/10- item -7- with the right Engine Support - Automatic Transmission Hook - 10-222A/7- item -8-.

The hooks from the Engine Support - Automatic Transmission Hook - 10-222A/7- point downward and will be engaged later in the cylinder block.

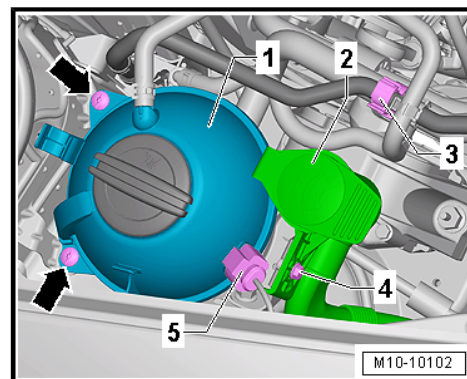
- Engage the left Engine Support Bridge - Spindle - 10-222A/11- item - 11- in the Engine/Gearbox Support Shackle (2 pc.) - 10-222A/12- item - 12-.

- Position the spindles and hold the engine and transmission. Do not lift.





- Remove the bolt -4- and rotate the windshield washer fluid reservoir filler tube -2- forward.
- Open the clip -3- and remove the connector -5- from the coolant expansion tank -1-.
- Remove the bolts -arrows- and place the coolant expansion tank -1- on top of the engine with the hoses connected.

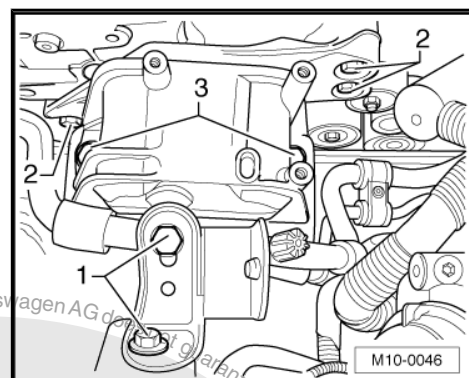


- Remove the bolts -1-, -2- and -3- and remove the engine mount.

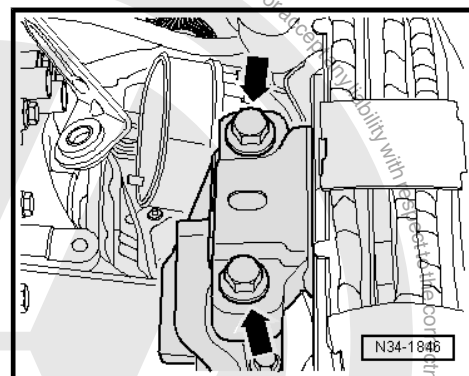


Note

The rear bolt -2- is accessible through a hole in the wheel housing.



- Remove the subframe mount bolts -arrows- on the transmission side.
- Slide engine as far as possible toward front and toward left.

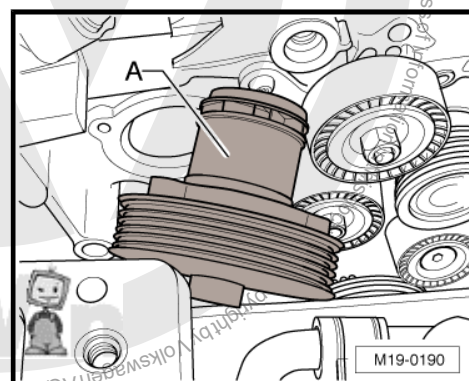


- Remove the three bolts -item 26- ⇒ [Item 26 \(page 155\)](#) and pivot out the coolant pump -A- as shown.

Installing

Install in reverse order of removal. Note the following:

- ♦ Pay attention to the installed position of the coolant pump. The plug inside the housing faces downward.
- ♦ Fill the coolant. Refer to ⇒ ["1.4 Coolant, Draining and Filling", page 147](#) .
- ♦ Install the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .



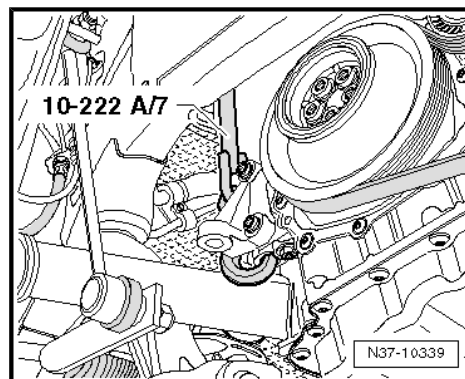
Tightening Specifications

Component	Nm
Install subframe mount	Refer to ⇒ "2.2 Engine Mount, Removing and Installing", page 22
Coolant pump to cylinder block	10



Note

Disengage the Engine Support - Automatic Transmission Hook - 10-222A/7- from the cylinder block -image- and remove.



2.3 Coolant Thermostat, Removing and Installing



Note

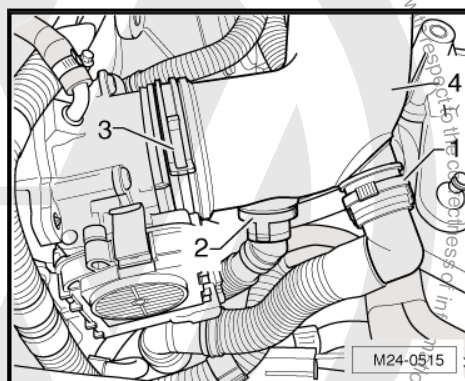
Checking coolant regulator -item 17- ⇒ [Item 17 \(page 154\)](#) .

Special tools and workshop equipment required

- ◆ Refractometer - T10007A-
- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Hose Clip Pliers - VAS6362-
- ◆ Cooling System Charge Kit - VAS6096-
- ◆ Cooling System Tester - Adapter - VAG1274/8-

Removing

- Drain the coolant. Refer to ⇒ [“1.4 Coolant, Draining and Filling”, page 147](#) .
- Remove the air filter housing (engine cover). Refer to ⇒ [“3.2 Air Filter Housing, Removing and Installing”, page 186](#) .
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-
- Remove intake manifold. Refer to ⇒ [“4.3 Intake Manifold, Removing and Installing”, page 189](#) .
- Place the oil dipstick tube back in the cylinder block and tighten, so that escaping coolant cannot run into the engine.
- Place a suitable container under coolant regulator housing to catch coolant flowing out.





- Remove the bolts -arrows-, pull off the connections -A- and then remove the coolant thermostat.

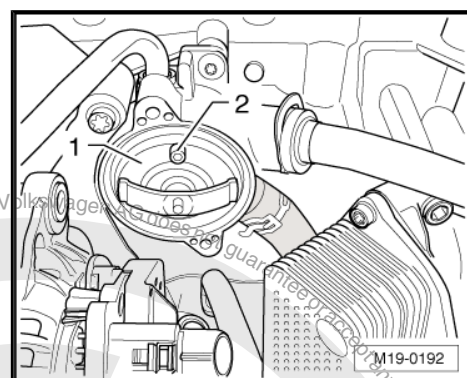
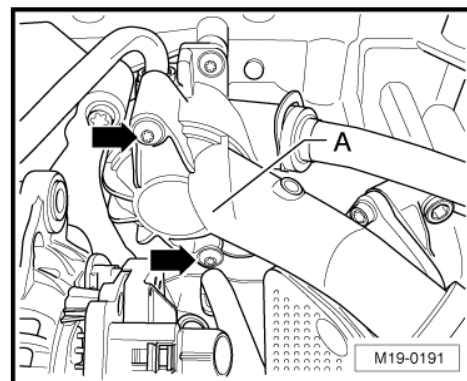
Installing

Install in reverse order of removal. Note the following:

- ◆ Replace sealing ring -item 18- ⇒ [Item 18 \(page 155\)](#) and O-ring -item 16- ⇒ [Item 16 \(page 154\)](#) .
- ◆ Note installation position of coolant regulator -1-. Valve -2- must point upward.
- ◆ Fill the coolant. Refer to ⇒ [“1.4 Coolant, Draining and Filling”, page 147](#) .

Tightening Specifications

Component	Nm
Connection to coolant thermostat housing	5



3 Radiator/Coolant Fan

⇒ [“3.1 Overview - Radiator/Coolant Fan”, page 166](#)

⇒ [“3.2 Radiator, Removing and Installing”, page 167](#)

⇒ [“3.3 Fan Shroud, Removing and Installing”, page 169](#)

⇒ [“3.4 Coolant Fan, Removing and Installing”, page 170](#)

3.1 Overview - Radiator/Coolant Fan



Note

- ◆ *Spring clamps secure the coolant hoses to the radiator.*
- ◆ *Coolant Hose Connection Diagram. Refer to ⇒ [“1.1 Connection Diagram - Coolant Hoses”, page 144](#) .*

1 - Coolant Hose

- ☐ From the rear coolant pipe

2 - Radiator

- ☐ Removing and Installing. Refer to ⇒ [“3.2 Radiator, Removing and Installing”, page 167](#) .
- ☐ After replacing, replace the entire amount of coolant.

3 - Upper Seal

4 - Cap

- ☐ Check using Cooling System Tester - VAG1274B- and Cooling System Tester - Adapter - VAG1274/9- . Refer to ⇒ [“1.3 Coolant System, Checking for Leaks”, page 146](#) .
- ☐ The pressure release valve must open at a pressure of 1.4 to 1.6 bar (20.30 to 23.20 psi)

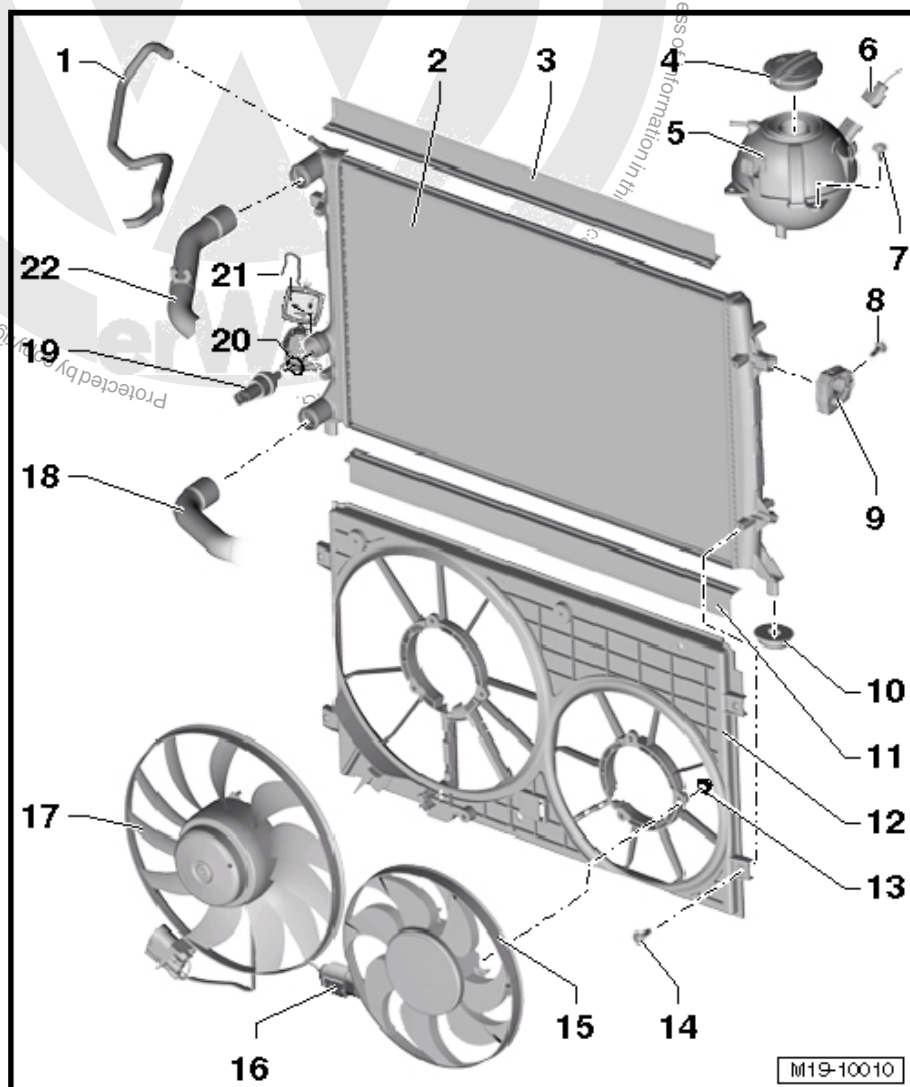
5 - Expansion Tank

- ☐ Perform a leak test for the coolant system using the Cooling System Tester - VAG1274B- and Cooling System Tester - Adapter - VAG1274/8- . Refer to ⇒ [“1.3 Coolant System, Checking for Leaks”, page 146](#) .

6 - Connector

7 - Bolt

- ☐ 2 Nm





8 - Bolt

- ☐ 5 Nm

9 - Bearing

- ☐ For the radiator

10 - Mount

- ☐ Insert in lock carrier

11 - Lower Seal

12 - Air Shroud

13 - Bolt

- ☐ 5 Nm

14 - Bolt

- ☐ 5 Nm

15 - Radiator Fan 2 - V177-

- ☐ Removing and Installing. Refer to ⇒ [“3.4.2 Coolant Fan 2 V177 , Removing and Installing”, page 170](#) .

16 - Connector

17 - Radiator Fan - V7-

- ☐ Removing and Installing. Refer to ⇒ [“3.4.1 Coolant Fan V7 , Removing and Installing”, page 170](#) .
- ☐ with Radiator Fan Control Module - J293-

18 - Lower Coolant Hose

- ☐ From connection for coolant regulator

19 - Engine Coolant Temperature Sensor on Radiator Outlet - G83-

20 - O-Ring

- ☐ Replace after removing

21 - Clamp

- ☐ Make sure it is secure

22 - Upper Coolant Hose

- ☐ From the coolant distribution housing to the cylinder head

3.2 Radiator, Removing and Installing

Special tools and workshop equipment required

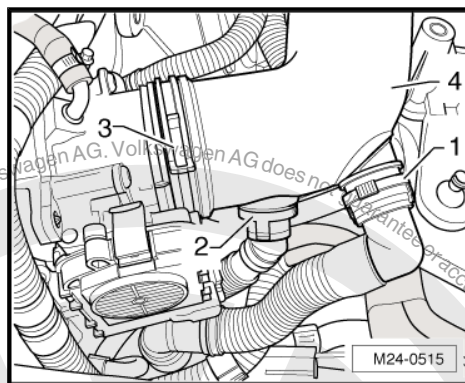
- ◆ Cooling System Tester - Adapter - VAG1274/8-
- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Hose Clip Pliers - VAS6362-
- ◆ Cooling System Charge Kit - VAS6096-
- ◆ Refractometer - T10007A-

Removing

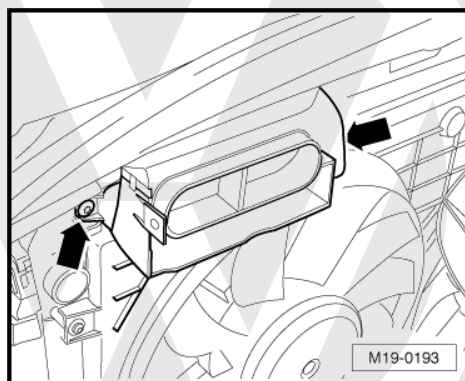
- Drain the coolant. Refer to
⇒ [“1.4 Coolant, Draining and Filling”, page 147](#) .
- Remove the air filter housing (engine cover). Refer to
⇒ [“3.2 Air Filter Housing, Removing and Installing”,
page 186](#) .



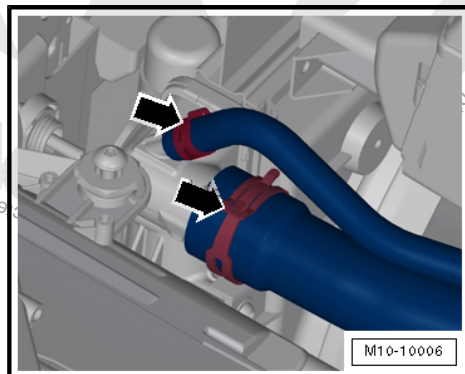
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.



- Remove the intake air scoop from the lock carrier -arrows-.
- Remove the fan shroud. Refer to [⇒ "3.3 Fan Shroud, Removing and Installing", page 169](#).



- Open the spring clamps -arrows- and remove the coolant hoses from the radiator.
- Remove the front bumper cover. Refer to ⇒ Body Exterior; Rep. Gr. 63 ; Front Bumper; Overview- Front Bumper Cover .



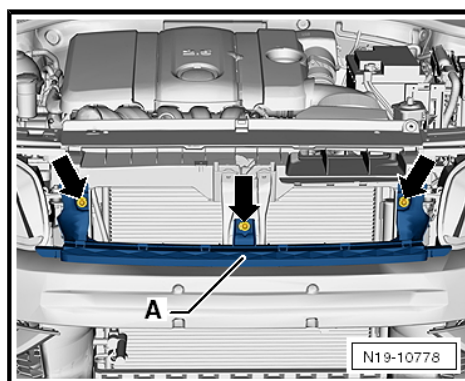
- Remove the bolts -arrows- and the center guide -A-.



Caution

To prevent damage to the condenser and the refrigerant lines, do not stretch, kink or bend the pipes and hoses.

- Remove the air guides -3- at the bottom.
- Remove the bolts -1- from the condenser.
- Remove the bolts -2- from the radiator mounts.
- Push the radiator to the rear and remove the radiator mounts (-item 9- ⇒ [Item 9 \(page 167\)](#)).





- Remove the radiator from its mounts in the lock carrier -item 10- ➔ [Item 10 \(page 167\)](#) .

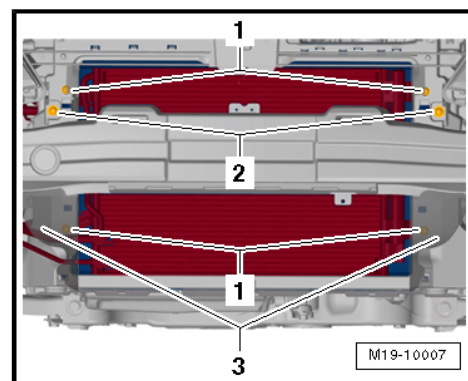
Installing

Install in reverse order of removal. Note the following:

- Fill the coolant. Refer to ➔ [“1.4 Coolant, Draining and Filling”, page 147](#) .

Tightening Specifications

- ◆ Refer to ➔ [“3.1 Overview - Radiator/Coolant Fan”, page 166](#)



3.3 Fan Shroud, Removing and Installing



Caution

The charge air pipe clamps must be tightened to 5.5 Nm. An insufficient or excessive tightening torque can cause the charge air hose to come off the charge air pipe while driving.

Special tools and workshop equipment required

- ◆ Torque Wrench 1783 - 2-10Nm - VAG1783-

Removing

- Remove the bolts -1- from the top.



Note

The left bolt is under the coolant connector.

- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .
- Disconnect the connector -2-.

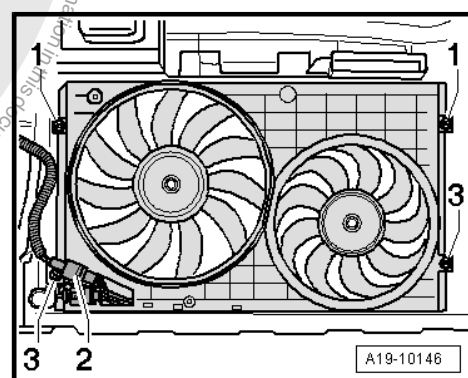
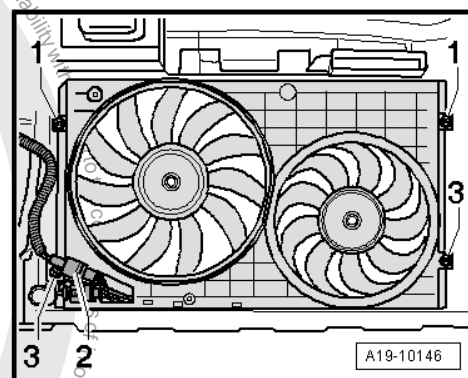
- Remove the bolts -3- and remove the fan shroud downward.

Installing

Install in reverse order of removal.

Tightening Specifications

- ◆ Refer to ➔ Body Exterior; Rep. Gr. 66 , Overview - Noise Insulation .
- ◆ Refer to ➔ [“3.1 Overview - Radiator/Coolant Fan”, page 166](#)





3.4 Coolant Fan, Removing and Installing

⇒ [“3.4.1 Coolant Fan V7 , Removing and Installing”, page 170](#)

⇒ [“3.4.2 Coolant Fan 2 V177 , Removing and Installing”, page 170](#)

3.4.1 Coolant Fan - V7 - , Removing and Installing

Removing



Note

During installation, all cable ties must be installed at the same location.

- Remove the fan shroud. Refer to [⇒ “3.3 Fan Shroud, Removing and Installing”, page 169](#).
- Disconnect the connector -arrow-.
- Remove the bolts -1-, and remove the Coolant Fan - V7- .

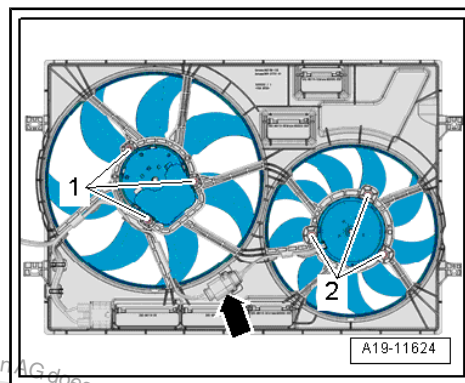
Installing

Install in reverse order of removal. Note the following:

- Install the fan shroud. Refer to [⇒ “3.3 Fan Shroud, Removing and Installing”, page 169](#).

Tightening Specifications

- ◆ Refer to [⇒ “3.1 Overview - Radiator/Coolant Fan”, page 166](#)



3.4.2 Coolant Fan 2 - V177- , Removing and Installing

Removing



Note

During installation, all cable ties must be installed at the same location.

- Remove the fan shroud. Refer to [⇒ “3.3 Fan Shroud, Removing and Installing”, page 169](#).
- Disconnect the connector -arrow-.
- Remove the bolts -2-, and remove the Coolant Fan 2 - V177- .

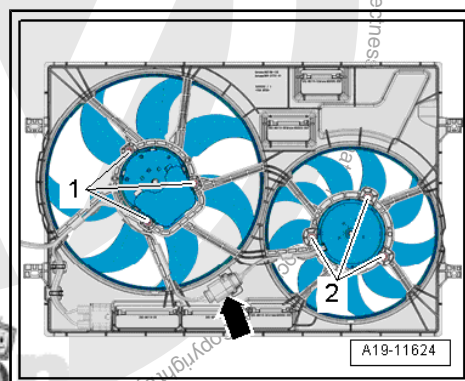
Installing

Install in reverse order of removal. Note the following:

- Install the fan shroud. Refer to [⇒ “3.3 Fan Shroud, Removing and Installing”, page 169](#).

Tightening Specifications

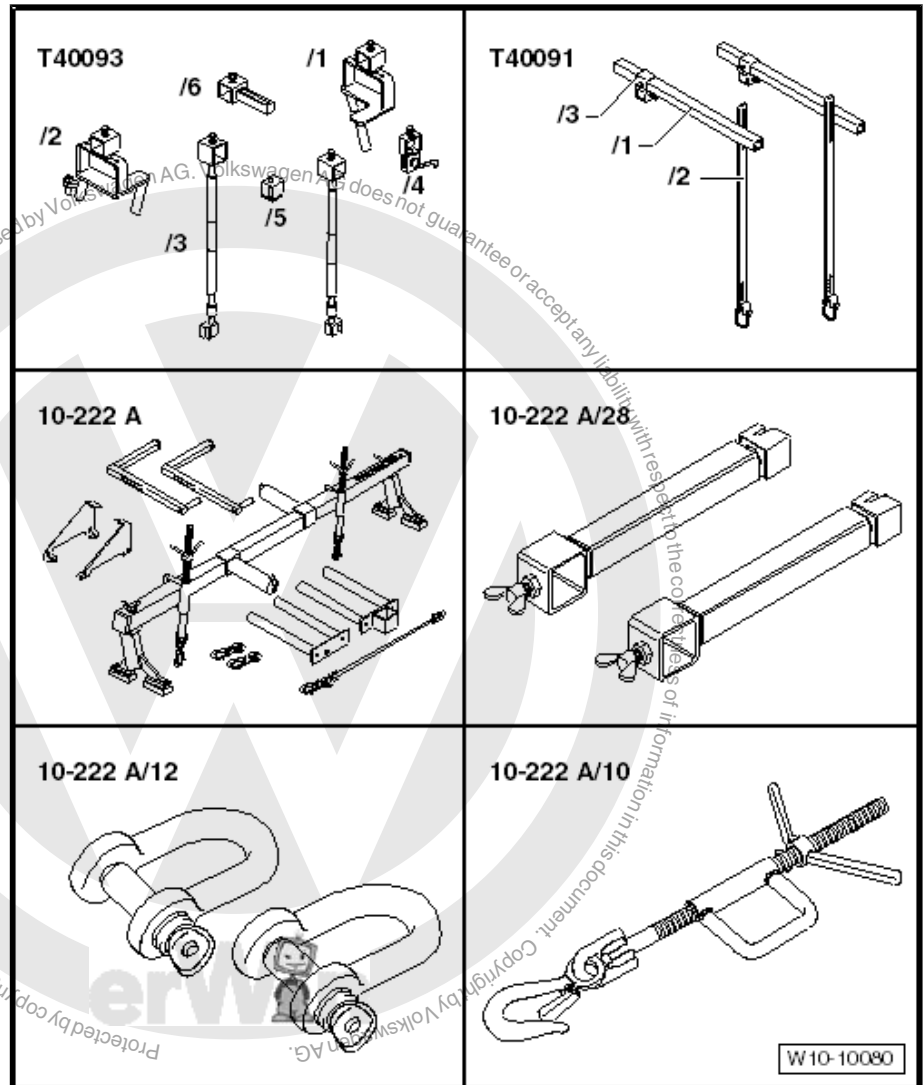
- ◆ Refer to [⇒ “3.1 Overview - Radiator/Coolant Fan”, page 166](#)



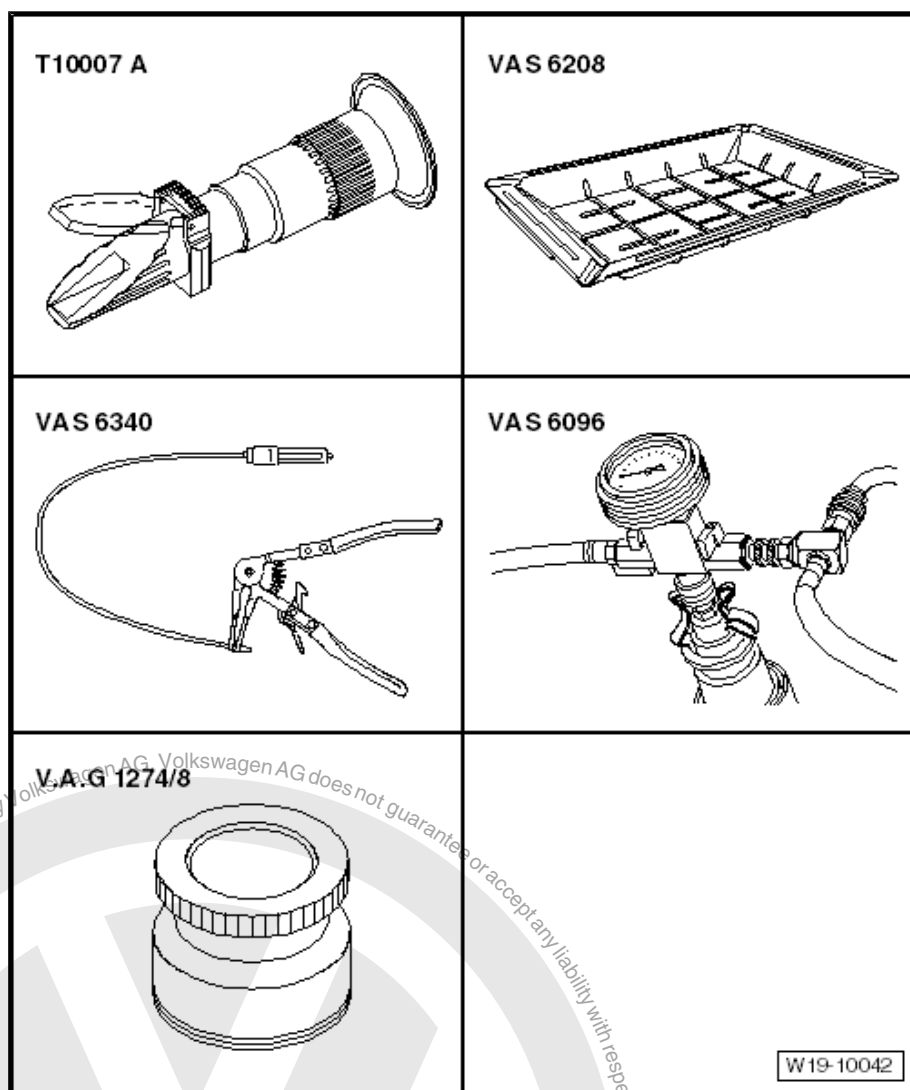


4 Special Tools

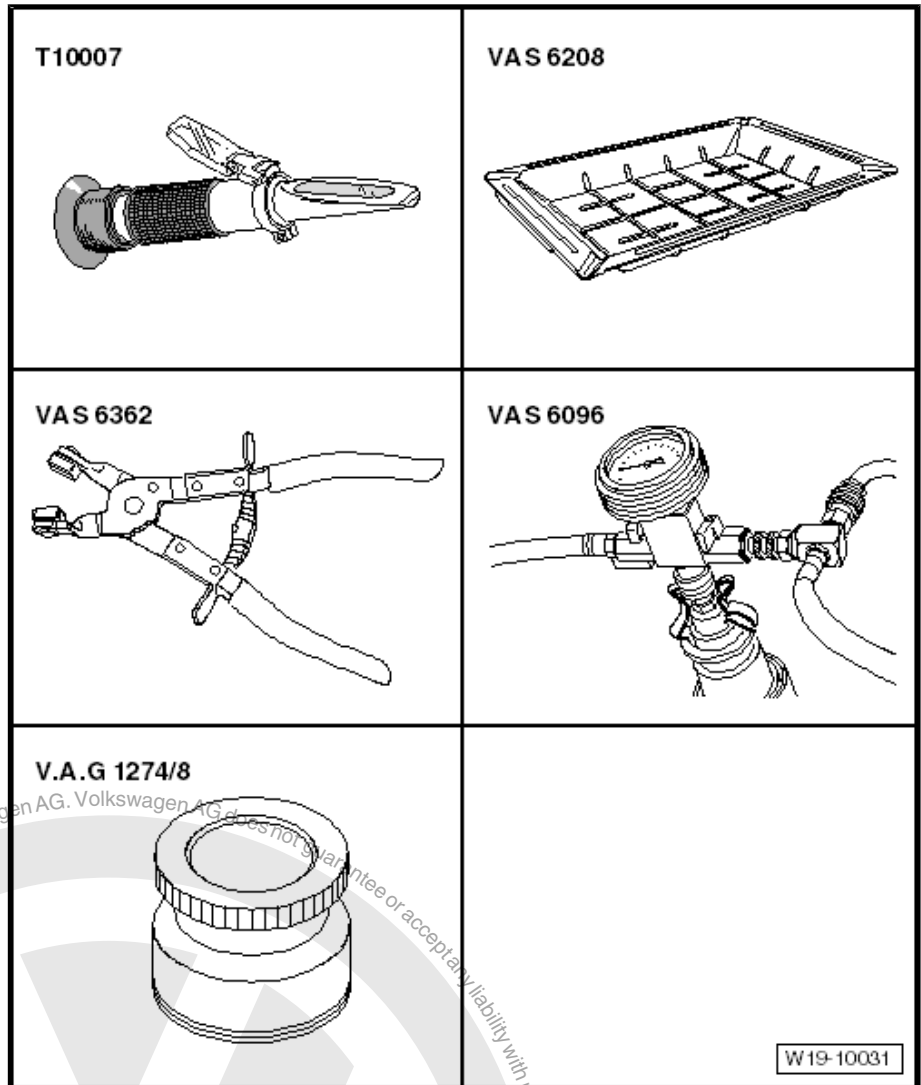
Special tools and workshop equipment required



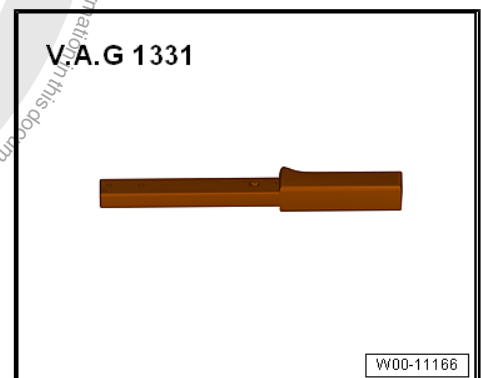
- ◆ Engine Support Bridge - 10-222A-
- ◆ Engine Support - Automatic Transmission Hook - 10-222A/7-
- ◆ Engine Support - Bracket w/Spindle and Hook - 10-222A/10-
- ◆ Engine Support Bridge - Engine Support 28 - 10-222A/28-
- ◆ Engine Support Bridge - Engine Support 31 - 10-222A/31-
- ◆ Rail with Holes - T40091/2-
- ◆ From the Engine Support - Basic Set - T40091-
- ◆ Engine Support - Supplement Kit Mount 5 - T40093/5- from the Engine Support - Supplement Kit - T40093A-
- ◆ Square Pipe - T40091/1- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40091/3- (quantity 2) from the Engine Support - Basic Set - T40091-
- ◆ Movable Joint - T40093/4- (quantity 2) from the Engine Support - Supplement Kit - T40091-



- ◆ Refractometer - T10007A-
- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Hose Clip Pliers - VAS6340-
- ◆ Cooling System Charge Kit - VAS6096-
- ◆ Cooling System Tester - Adapter - VAG1274/8-
- ◆ Protective eyewear
- ◆ Safety Gloves

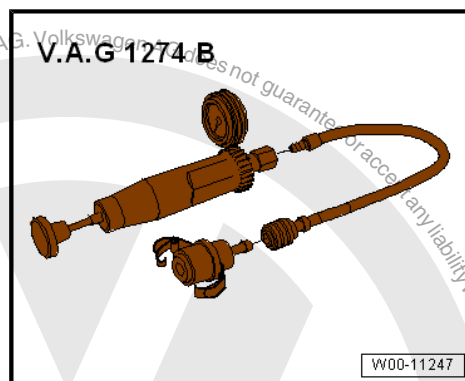


- ◆ Cooling System Tester - Adapter - VAG1274/8-
- ◆ Shop Crane - Drip Tray - VAS6208-
- ◆ Hose Clip Pliers - VAS6362-
- ◆ Cooling System Charge Kit - VAS6096-
- ◆ Refractometer - T10007A-
- ◆ Torque Wrench 1331 5-50Nm - VAG1331-

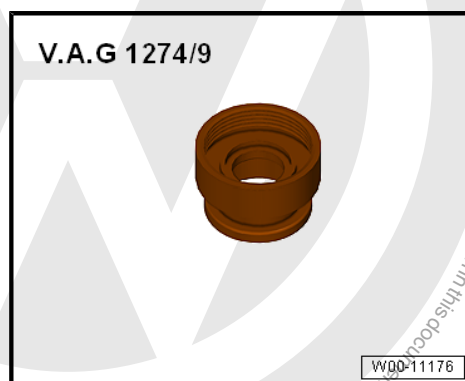




◆ Cooling System Tester - VAG1274B-



◆ Cooling System Tester - Adapter VAG1274/9-



◆ Torque Wrench 1783 - 2-10Nm - VAG1783-





24 – Multiport Fuel Injection

1 Fuel Injection System

⇒ [“1.1 Component Location Overview - Fuel Injection System”, page 175](#)

⇒ [“1.2 Fuel System, Filling/Bleeding”, page 176](#)

1.1 Component Location Overview - Fuel Injection System

1 - Cylinder 1 through 5 Fuel Injectors - N30, N31, N32, N33 and N83-

- ❑ Removing and Installing. Refer to
 ⇒ [“2.2 Fuel Injectors, Removing and Installing”, page 179](#) .

**2 - Knock Sensor 1 - G61-
 Knock Sensor 2 - G66-**

- ❑ Knock sensor 1 component location. Refer to
 ⇒ [“1.3 Knock Sensor 1 G61, Removing and Installing”, page 220](#) .
- ❑ Knock sensor 2 component location. Refer to
 ⇒ [“1.3 Knock Sensor 1 G61, Removing and Installing”, page 220](#) .

3 - Secondary Air Injection Solenoid Valve - N112-

- ❑ For secondary air injection system
- ❑ Checking. Refer to
 ⇒ [“3.4 Secondary Air Injection Solenoid Valve, Checking”, page 213](#) .

4 - Heated Oxygen Sensor - G39- from the Catalytic Converter; Oxygen Sensor in Bank 1 Center Three Way Catalytic Converter - G465- only for Engine Code CBUA; Oxygen Sensor after Three Way Catalytic Converter - G130-

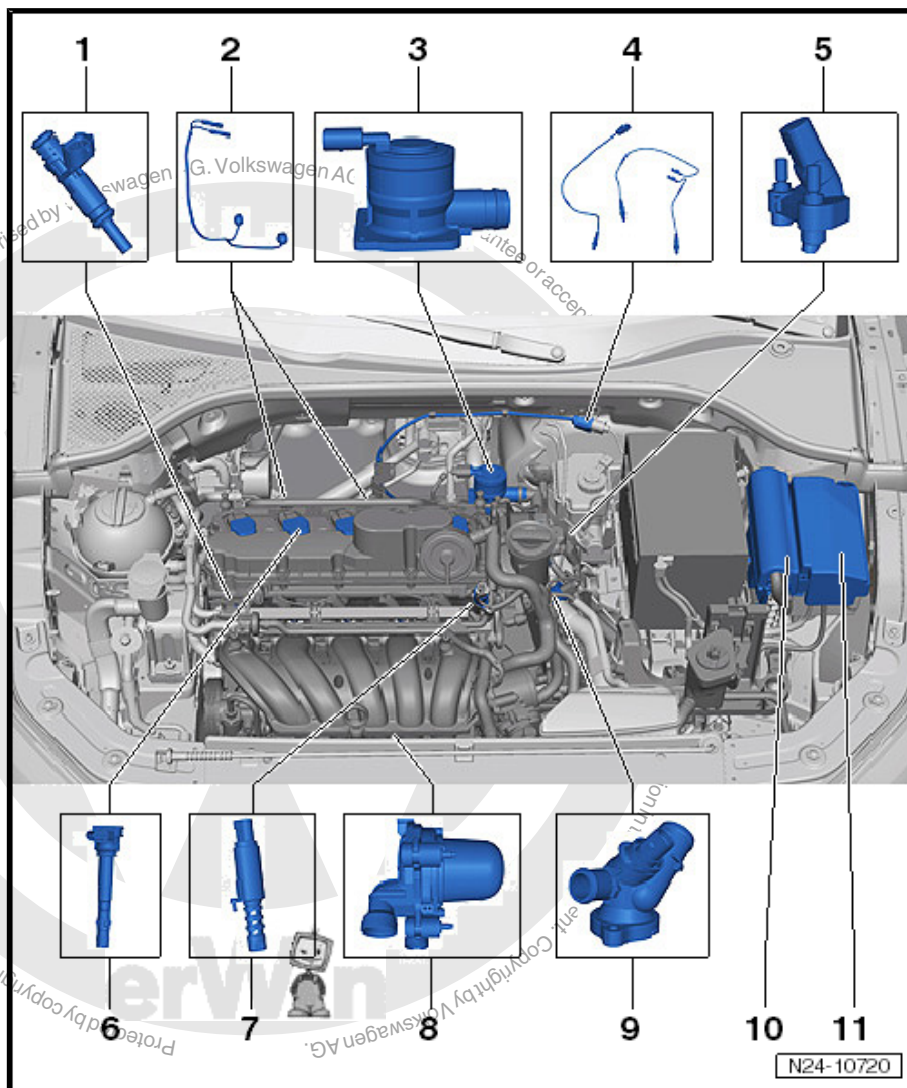
- ❑ 55 Nm
- ❑ Only grease the threads with Hot Bolt Paste - G 052 118 A3- ; the Hot Bolt Paste - G 052 118 A3- must not enter the slits on the sensor body

5 - Engine Speed Sensor - G28-

- ❑ Secured to control housing cover

6 - Ignition Coils with Power Output Stage - N70, N127, N291, N292, N323-

- ❑ Removing and Installing. Refer to
 ⇒ [“1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 219](#) .



N24-10720



7 - Camshaft Adjustment Valve 1 - N205-

8 - Secondary Air Injection Pump Motor - V101-

- ❑ Removing and Installing. Refer to
⇒ ["3.2 Secondary Air Injection Pump Motor V101 , Removing and Installing", page 211](#) .

9 - Engine Coolant Temperature Sensor - G62-

- ❑ If necessary, release the pressure in coolant system before removing.

10 - Engine Control Module - J623-

- ❑ Installed location next the engine compartment E-box on the left side
- ❑ Removing and Installing. Refer to ⇒ ["5 Engine Control Module", page 193](#) .

11 - E-Box Inside the Engine Compartment on the Left Side

- ❑ Relay and fuse locations. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations



Note

The Intake Air Temperature Sensor - G42- is installed on the intake manifold with the Manifold Absolute Pressure Sensor - G71- .

The Following Components are Not Displayed in the Overview:

Manifold Absolute Pressure Sensor - G71-

- ◆ Component location: under the Throttle Valve Control Module - J338-

Accelerator Pedal Position Sensor - G79- / Accelerator Pedal Position Sensor 2 - G185-

- ◆ Component location: inside the accelerator pedal

Leak Detection Pump - V144-

- ◆ Component location: under the wheel housing liner inside right rear wheel housing

Clutch Position Sensor - G476-

- ◆ Only for vehicles with a manual transmission
- ◆ Component location: on the clutch master cylinder

1.2 Fuel System, Filling/Bleeding

Special tools and workshop equipment required

- ◆ Fuel Injection Gauge Kit - Fuel Bleeder 20 - VAG1318/20-
- ◆ Suction Pump - VAS5226-
- ◆ Vehicle Diagnostic Tester



Note

- ◆ *If fuel supply system was opened, it must always be bled before starting engine.*
- ◆ *If fuel supply system is not bled, catalytic converter will be damaged.*
- ◆ *Pay attention to the safety precautions. Refer to
⇒ ["1 Safety Precautions", page 1](#) .*
- ◆ *Follow the rules of cleanliness. Refer to
⇒ ["4.1 Guidelines for Clean Working Conditions", page 7](#) .*



Procedure



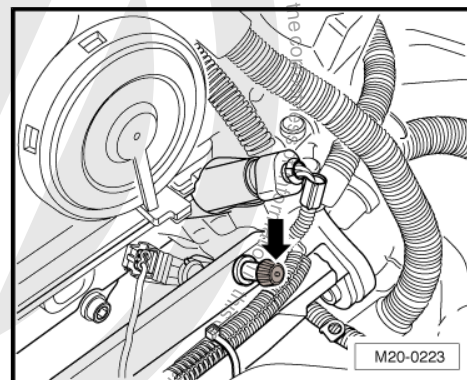
WARNING

Fuel lines are under pressure.

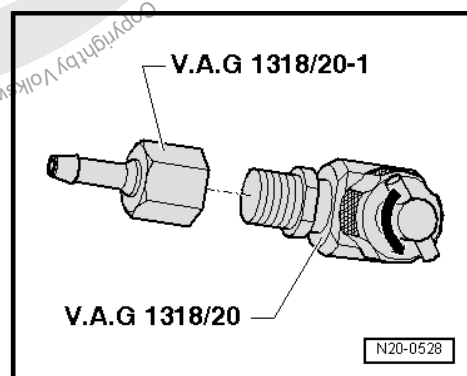
Fuel poses a risk of danger of injury to eyes and skin.

Wear protective eyewear and protective clothing in order to avoid injury and contact with the skin. Place a cloth on the connection location before loosening hose connections. Open the connection carefully and release the pressure.

- Remove the bleeder valve cap -arrow-.

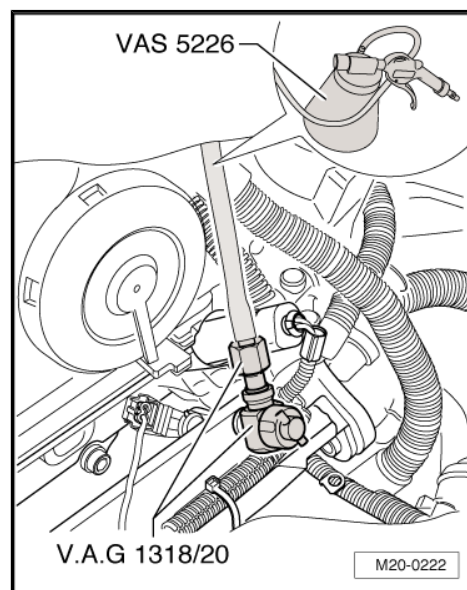


- Turn valve (on T-piece) counter-clockwise until it is completely open.
- Attach the Puller - Kukko 2-Arm, Up To 90mm Width, 100mm Length - 20-1- to the Fuel Injection Gauge Kit - Fuel Bleeder 20 - VAG1318/20- .
- Install the Fuel Injection Gauge Kit - Fuel Bleeder 20 - VAG1318/20- hand-tight on the bleeder valve.



- Connect the hose from the Suction Pump - VAS5226- as shown.
- Turn valve (on T-piece) clockwise until it stops in the bleeder valve.
- Check the adapter and hose connections for leaks.

Connect the Vehicle Diagnostic Tester as follows:





- Connect the diagnostic cable connector **2** to the diagnostic connection inside the driver footwell.

- On the touch screen, select the following:

OBD

OBD ►

Engine electronics ►

Output diagnostic test ►

- Keep pressing ► until the fuel pump relay activates. This activates the fuel pump. Let the diagnostic run until fuel flows out of the ventilation valve without bubbles. Then end the output diagnostic test mode.

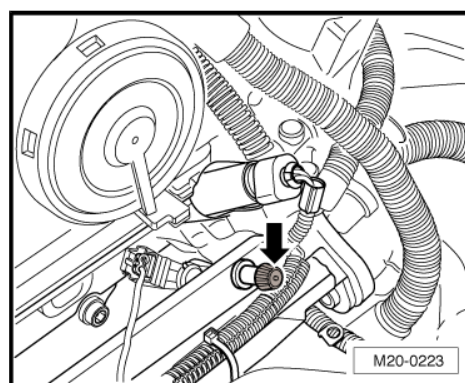
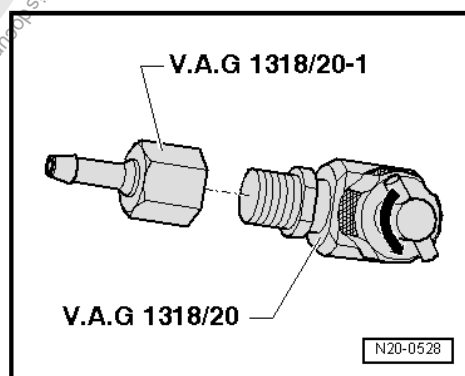
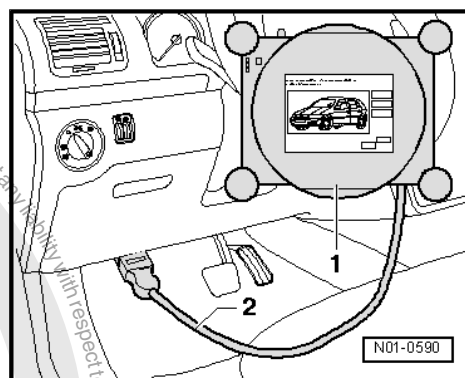


Note

If the output diagnostic test mode is interrupted, the engine must be started for a short time before the mode can be accessed again. Output diagnostic test mode is automatically cancelled after 60 seconds.

- Turn valve (on T-piece) counter-clockwise until it is completely open again.
- Clamp together the hose from the Suction Pump - VAS5226- and from the Puller - Kukko 2-Arm, Up To 90mm Width, 100mm Length - 20-1- (for example with a Hose Clamps - Up To 25mm - 3094-).
- Remove the Fuel Injection Gauge Kit - Fuel Bleeder 20 - VAG1318/20- from the bleeder valve.

- Reinstall the bleeder valve cap -arrow-.





2 Fuel Injectors

⇒ [“2.1 Overview - Fuel Rail with Fuel Injectors”, page 179](#)

⇒ [“2.2 Fuel Injectors, Removing and Installing”, page 179](#)

⇒ [“2.3 Fuel Injectors, Checking”, page 181](#)

2.1 Overview - Fuel Rail with Fuel Injectors

1 - Bolt

- ☐ 3.5 Nm

2 - Fuel Rail

3 - Fuel Supply Line

4 - O-Ring

- ☐ Replace after removing
- ☐ Coat with clean engine oil

5 - Clamp

- ☐ Make sure clip is correctly seated on fuel injector and fuel distributor

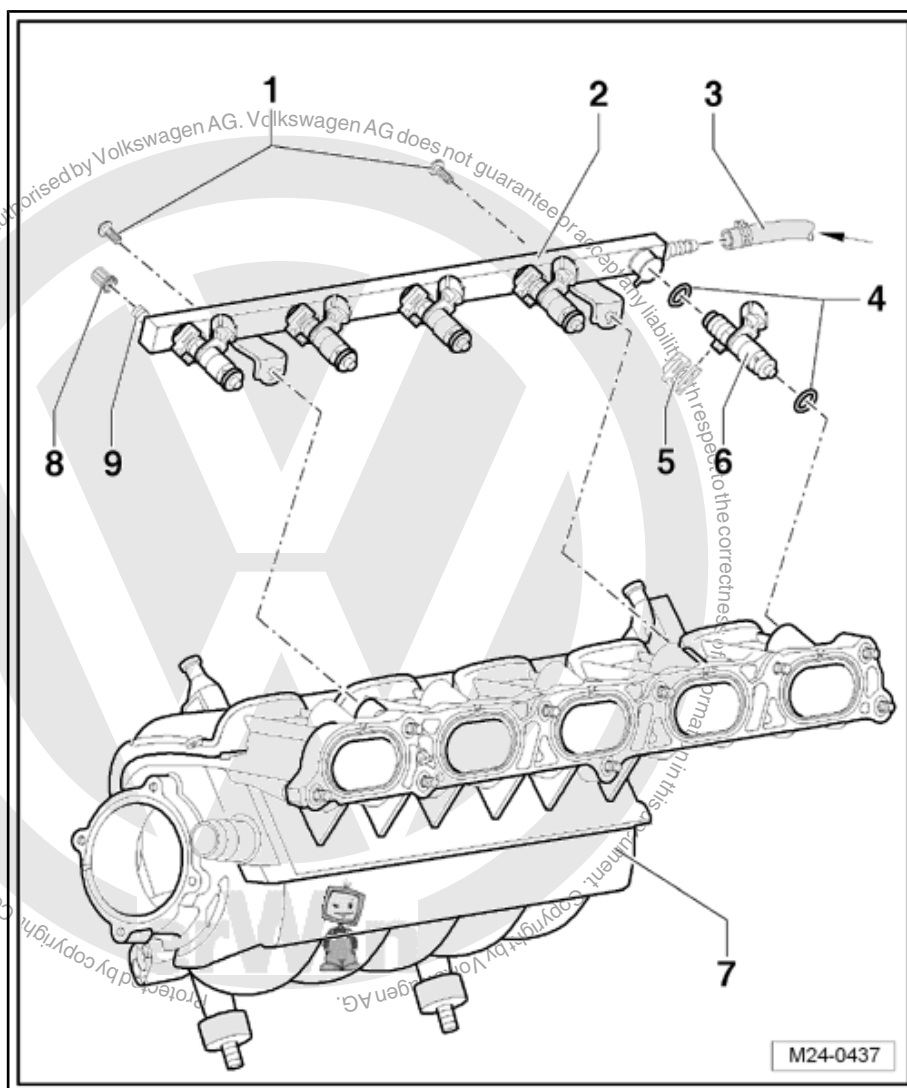
6 - Cylinder 1 through 5 Fuel Injectors - N30, N31, N32, N33 and N83-

- ☐ Removing and Installing. Refer to [⇒ “2.2 Fuel Injectors, Removing and Installing”, page 179](#).
- ☐ Checking. Refer to [⇒ “2.3 Fuel Injectors, Checking”, page 181](#).

7 - Intake Manifold

8 - Protective cap

9 - Bleeder Valve



2.2 Fuel Injectors, Removing and Installing

Removing

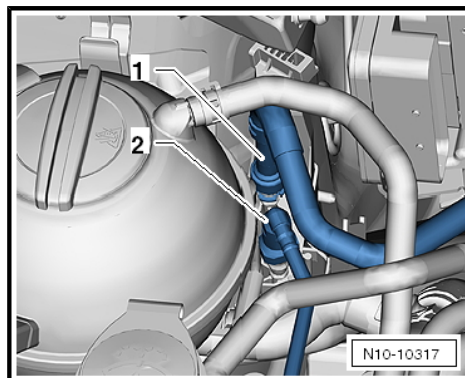


Note

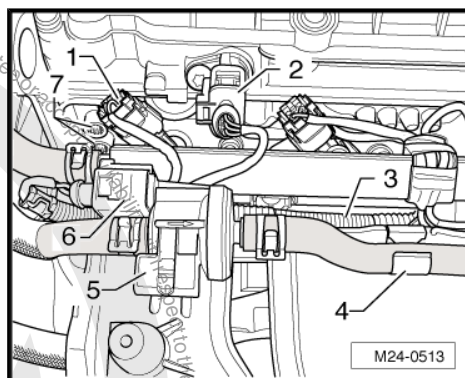
- ◆ Pay attention to the safety precautions. Refer to [⇒ “1 Safety Precautions”, page 1](#).
- ◆ Follow the rules of cleanliness. Refer to [⇒ “4.1 Guidelines for Clean Working Conditions”, page 7](#).



- Disconnect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .
- Remove the air filter housing (engine cover). Refer to ⇒ ["3.2 Air Filter Housing, Removing and Installing", page 186](#) .
- Disconnect the fuel supply line -1- and the bleeder line -2-. Refer to ⇒ Rep. Gr. 20 ; Couplings, Disconnecting Couplings .
- Seal the lines so that the fuel system is not contaminated by dirt etc.



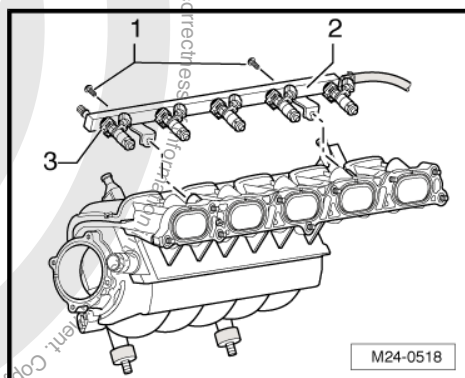
- Remove the connector -1-, -2- and -6-.
- Remove the wiring harness -3- from the transport strap.
- Remove the clamps -4- and the retaining ring -5- from the catch.
- Remove the bolts -7- and the transport strap.
- Remove the bolts -1- and pull the fuel rail with the fuel injectors out of the intake manifold.
- Seal off or cover the openings in the intake manifold.



- Remove the clips -3- and then the fuel injectors.

Installing

- Install new O-rings for fuel injectors and coat them lightly with clean engine oil.

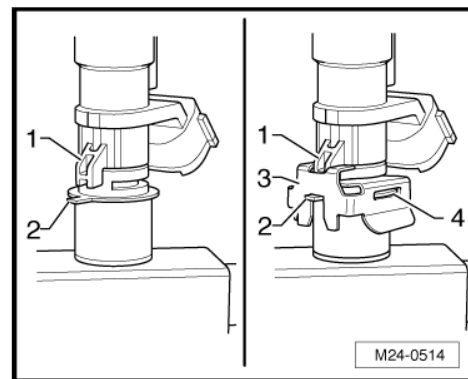




- Install the fuel injectors into the fuel rail so that the tabs -1- and -2- line up with each other.
- Install the clip -3- into the groove on the fuel injector as illustrated. The shoulder -4- must be correctly located in the cutout of the retaining clip on both sides.
- Check that the fuel injectors are secure after installing them.
- Position the fuel rail with secured fuel injectors on intake manifold and apply uniform pressure to press it in.
- Attach the fuel rail on the intake manifold.

The rest of the installation follows the reverse of the removal procedures. Note the following:

- Connect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .



Note

If the fuel injectors were replaced, erase the adaptation values and re-adapt the engine control module see Vehicle Diagnostic Tester "Guided Fault Finding" function.

- Bleed the fuel system. Refer to
 ⇒ ["1.2 Fuel System, Filling/Bleeding", page 176](#) .

Tightening Specifications

- ◆ Refer to
 ⇒ ["2.1 Overview - Fuel Rail with Fuel Injectors", page 179](#)
- ◆ Refer to ⇒ ["4.1 Overview - Intake Manifold", page 187](#)

2.3 Fuel Injectors, Checking

Special tools and workshop equipment required

- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ Injection Rate Comparison Meter Kit - Adapter - VAG1348/3-2-
- ◆ Injection Rate Tester - VAG1602-
- ◆ Connector Test Set - VAG1594D-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 5 Pin - VAS5565-



Note

- ◆ *Pay attention to the safety precautions. Refer to
 ⇒ ["1 Safety Precautions", page 1](#) .*
- ◆ *Follow the rules of cleanliness. Refer to
 ⇒ ["4.1 Guidelines for Clean Working Conditions", page 7](#) .*

Checking for Leaks

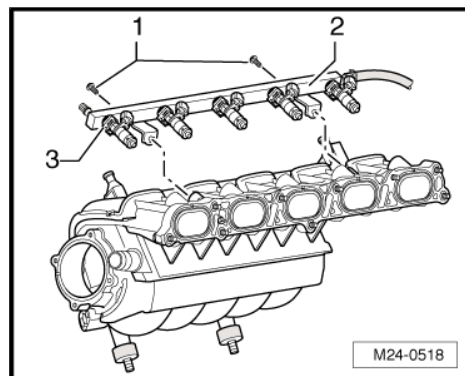
- The fuel pressure must be OK. Refer to ⇒ Rep. Gr. 20 ; Fuel Pump .



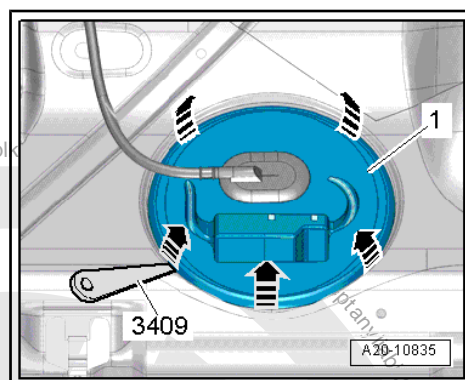
- Remove the fuel rail -2- with the fuel injectors installed. Refer to ⇒ [“2.2 Fuel Injectors, Removing and Installing”, page 179](#) .

Do not disconnect battery and do not disconnect fuel supply line at quick acting coupling or at fuel rail.

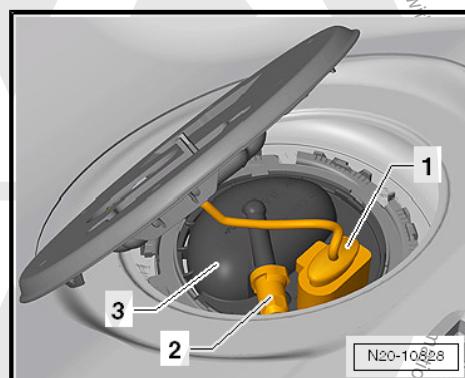
- The connectors must be disconnected from the fuel injectors.
- Remove the bench seat. Refer to ⇒ Body Interior; Rep. Gr. 72 ; Rear Seats; Bench Seat / Single Seats, Removing and Installing .



- Unclip the cover -1- at the tabs in direction of -arrows- using the Trim Removal Wedge - 3409- .



- Remove the connector -1-.





- Attach the Vehicle Diagnostic Tester - Test Adapter - 5 Pin - VAS5565- to the connector and to the fuel delivery unit.
- Connect the Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A- to the Vehicle Diagnostic Tester - Test Adapter - 5 Pin - VAS5565- and battery positive (+).
- Push the Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A- . The fuel pump must start running.



Note

This work step allows the fuel pump to run when the engine is not running.

- Check injectors for leaks (visual inspection).
- Only 1 to 2 drops per minute may emit from each valve when fuel pump is running.

If the fuel loss is greater:

- Disconnect connection to battery plus (+) and replace leaking fuel injector. Refer to [⇒ “2.2 Fuel Injectors, Removing and Installing”, page 179](#) .

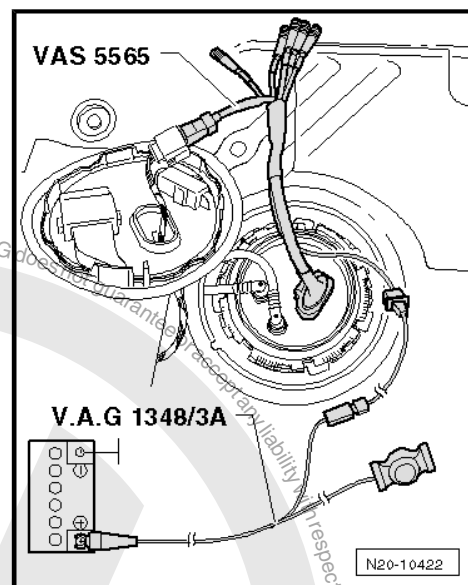


Note

- ◆ *If the fuel injectors were replaced, erase the adaptation values and re-adapt the engine control module see Vehicle Diagnostic Tester “Guided Fault Finding” function.*
- ◆ *Use new gaskets.*

Injection Quantity, Checking

- The fuel pressure must be OK. Refer to ⇒ Rep. Gr. 20 ; Fuel Pump .
- Fuel rail removed.
- Fuel injectors installed in fuel rail and fuel line connected.
- Fuel pump runs (connected to battery with adapter cables).
- Insert a fuel injector to be checked in a measuring glass from the Injection Rate Tester - VAG1602- .



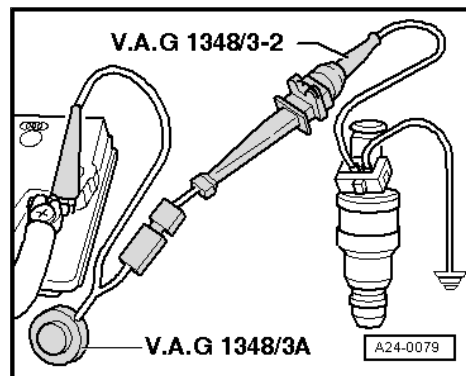


- Using adapter cables from the Connector Test Set - VAG1594D- , connect one terminal of the fuel injector to be checked to the engine ground.
- Connect the second terminal of the fuel injector to the Injection Rate Comparison Meter Kit - Remote Cable -VAG1348/3A- using the Injection Rate Comparison Meter Kit - Adapter - VAG1348/3-2 .
- Connect the alligator clip to the battery positive (+) .
- Operate the Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A- for 30 seconds.
- Repeat the test on the other fuel injectors. Use new graduated measuring glasses for this.
- After all fuel injectors have been activated, place graduated measuring glasses on a level surface and compare quantity of injected fuel.
- Specified value: 85 to 105 ml (2.87 to 3.55 ounces) per valve

While checking the injection quantity, the spray pattern should also be checked. Spray pattern must be the same for all fuel injectors.

If the measured value of one or more fuel injectors is below or above the indicated specified value:

- Replace the faulty fuel injector. Refer to
⇒ ["2.2 Fuel Injectors, Removing and Installing", page 179](#) .





3 Air Filter

⇒ [“3.1 Overview - Air Filter Housing”, page 185](#)

⇒ [“3.2 Air Filter Housing, Removing and Installing”, page 186](#)

3.1 Overview - Air Filter Housing

The air filter housing is also the engine cover.

1 - Spring Clamp

2 - Intake Hose

- To the throttle valve control module

3 - Bolt

- 3 Nm

4 - Connecting Piece

5 - Air Filter Upper Section

6 - Rubber Bushing

- Do not use lubricant

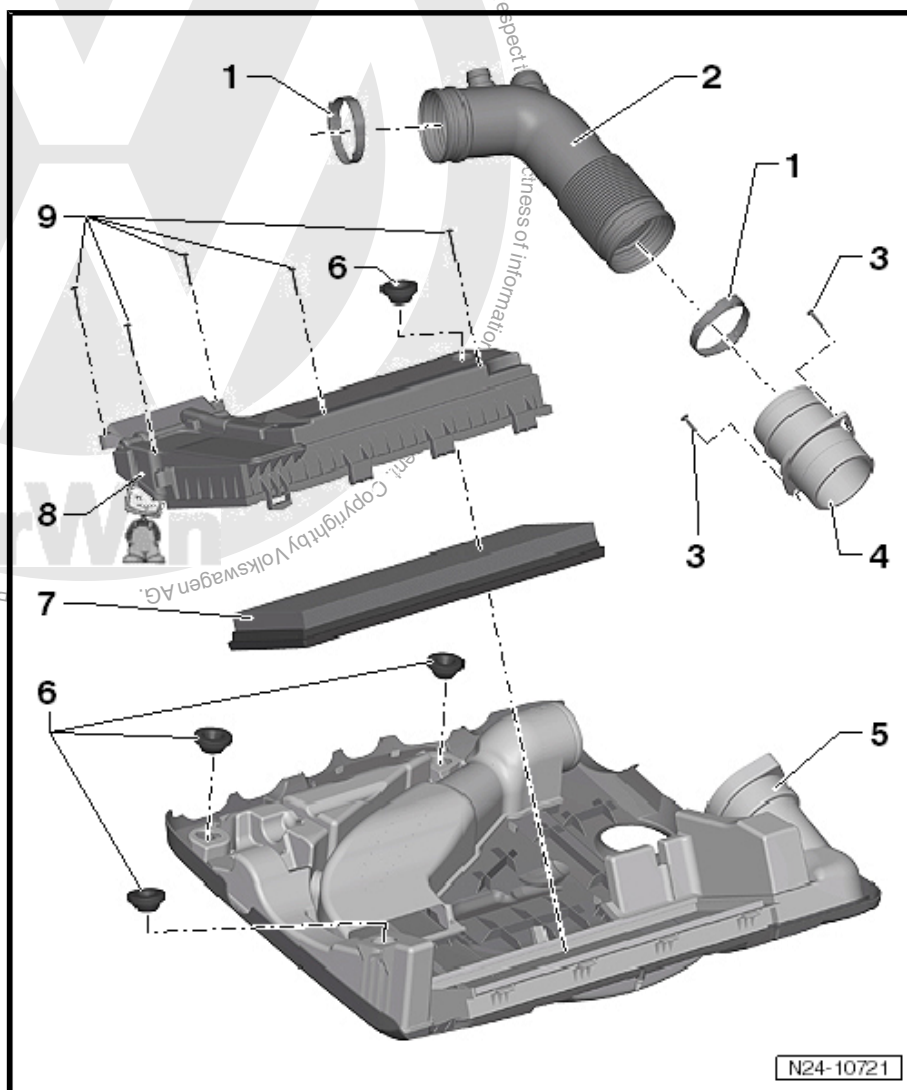
7 - Filter Element

8 - Air Filter Lower Section

- The warm air connection has been discontinued.

9 - Bolts

- Follow the tightening sequence. Refer to
⇒ [Fig. “Air Filter Lower Section Tightening Sequence”](#), page 185.

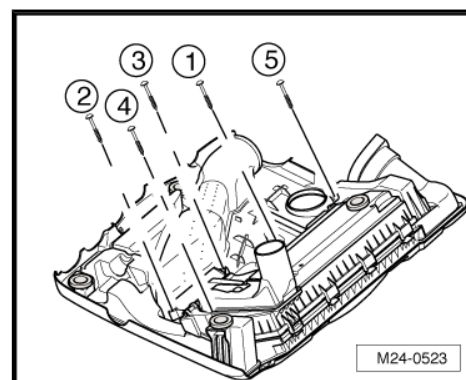


N24-10721

Air Filter Lower Section Tightening Sequence

- Tighten the bolts in the sequence -1- through -5-, as shown.

Step	Bolts	Tightening Specification/Additional Turn
1.	-1- through -5-	2 Nm



M24-0523



3.2 Air Filter Housing, Removing and Installing

Removing

- Loosen the spring clamp -2- and the intake hose.
- Remove the bolts -3- and the intake hose.



Note

Ignore item 1.

- Pull the engine with a jerk out of the mounts first at the front in direction of -arrow 1-, then at the right rear in direction of -arrow 2- and finally at the left rear in direction of -arrow 3-.

- Carefully swivel engine cover out of rear area.

Installing

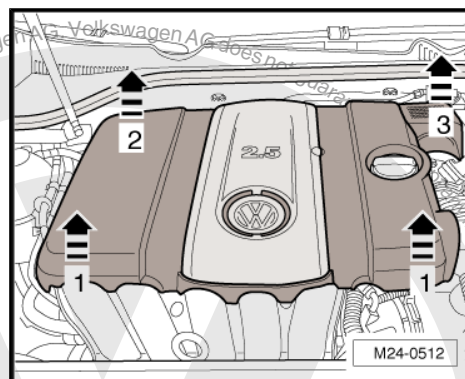
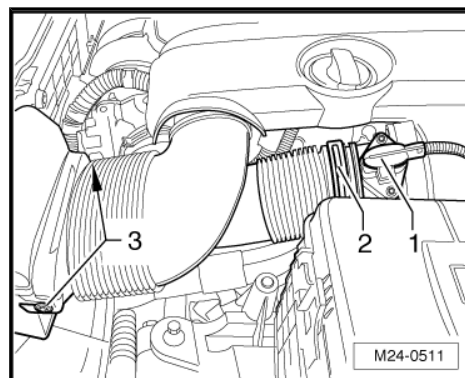


Note

Rubber bushings -item 6- ⇒ **Item 6 (page 185)** must not be treated with lubricant, neither for assembly in air filter nor for assembly on engine.

- Position engine cover correctly in mounts and press in by hand.

The rest of the installation follows the reverse of the removal procedures.





14 - Manifold Absolute Pressure Sensor - G71- with Intake Air Temperature Sensor - G42-

- ☐ Not installed in engine code CCCA, the opening is closed

15 - Bolt

- ☐ 3.5 Nm

16 - Bolt

- ☐ 6.5 Nm

17 - Throttle Valve Control Module - J338-

- ☐ With EPC Throttle Drive - G186- , EPC Throttle Drive Angle Sensor 1 - G187- and EPC Throttle Drive Angle Sensor 2 - G188-
- ☐ When replacing, erase the adaptation values and adapt the engine control module to the throttle valve control module see Vehicle Diagnostic Tester "Guided Fault Finding" function

18 - Seal

- ☐ Replace if damaged

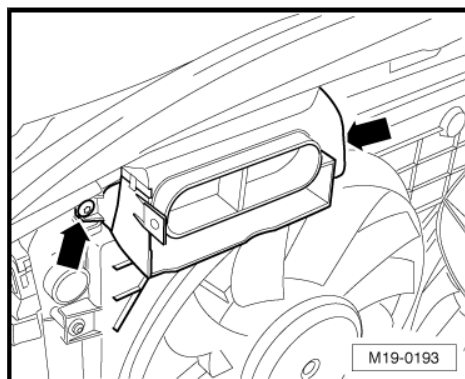
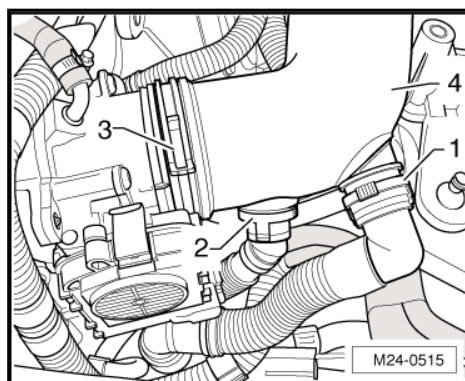
4.2 Throttle Valve Control Module - J338- , Removing and Installing

Removing



Note

- ♦ Pay attention to the safety precautions. Refer to ["1 Safety Precautions", page 1](#) .
- ♦ Follow the rules of cleanliness. Refer to ["4.1 Guidelines for Clean Working Conditions", page 7](#) .
- Remove the air filter housing (engine cover). Refer to ["3.2 Air Filter Housing, Removing and Installing", page 186](#) .
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.
- Remove the intake air connection from the lock carrier -arrows-.





- Disconnect the connector -1- and the ventilation hose -2-.
- Remove the bolts -arrows-.
- Remove the throttle valve control module.

i Note

Seal the intake channel in intake manifold using a clean cloth.

Installing

Install in reverse order of removal. Note the following:

- ◆ Replace sealing ring for throttle valve control module if damaged.
- ◆ Make sure air hoses -1- and -2- are fitted securely.
- ◆ When replacing, erase the adaptation values and adapt the engine control module to the throttle valve control module see Vehicle Diagnostic Tester "Guided Fault Finding" function.

Tightening Specifications

- ◆ Refer to ⇒ ["4.1 Overview - Intake Manifold", page 187](#)
- ◆ Refer to ⇒ ["2.1 Overview - Fuel Rail with Fuel Injectors", page 179](#)

4.3 Intake Manifold, Removing and Installing

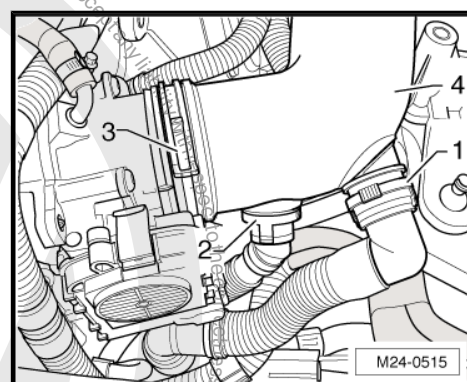
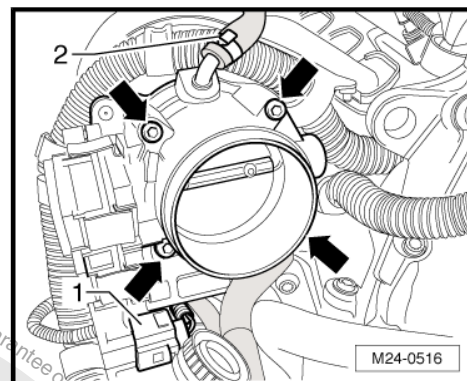
Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - VAG1331-
- ◆ Socket and Extended Bit - T10107A-

Removing

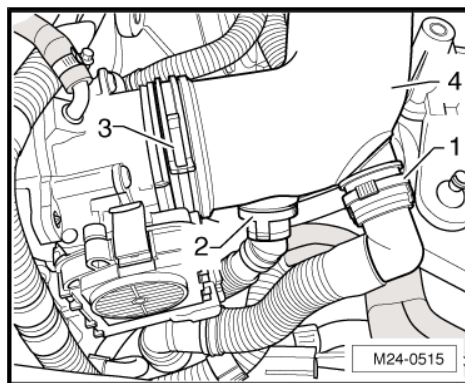
i Note

- ◆ *Pay attention to the safety precautions. Refer to ⇒ ["1 Safety Precautions", page 1](#).*
- ◆ *Follow the rules of cleanliness. Refer to ⇒ ["4.1 Guidelines for Clean Working Conditions", page 7](#).*
- Disconnect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .
- Remove the air filter housing (engine cover). Refer to ⇒ ["3.2 Air Filter Housing, Removing and Installing", page 186](#).

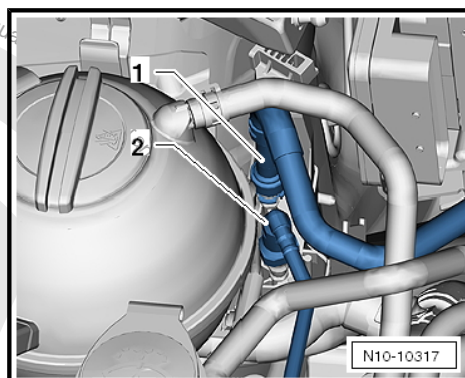




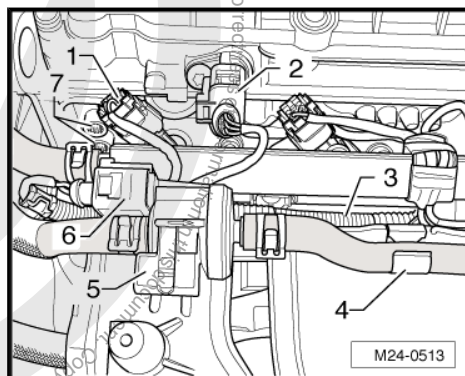
- Remove the intake hose -4- between the Throttle Valve Control Module - J338- and the air filter. To do so, disconnect air hose -1-, if present, and air hose -2- (compress securing ring) and remove spring clamp -3-.



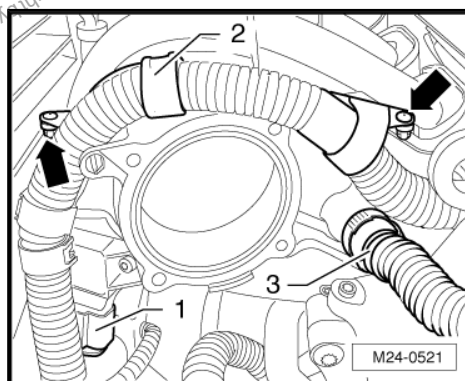
- Disconnect the fuel supply line -1- and the bleeder line -2-. Refer to ➔ Rep. Gr. 20 ; Couplings, Disconnecting Couplings .
- Seal the lines so that the fuel system is not contaminated by dirt etc.
- Seal the lines so that the fuel system is not contaminated by dirt etc.



- Remove the connector -1-, -2- and -6-.
- Remove the wiring harness -3- from the transport strap.
- Remove the clamps -4- and the retaining ring -5- from the catch.
- Remove the bolts -7- and the transport strap.
- Remove the Throttle Valve Control Module - J338- . Refer to ➔ ["4.2 Throttle Valve Control Module J338 , Removing and Installing", page 188](#) .

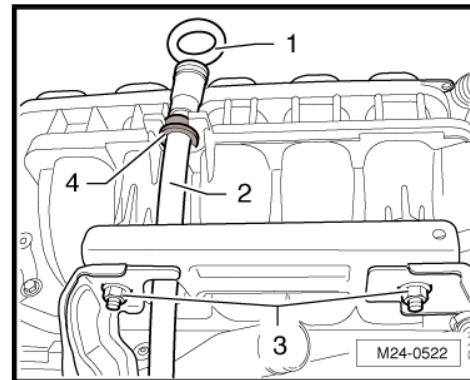


- Disconnect the connector -1- and the crankcase ventilation hose -3-.
- Remove the wiring harness -2-. Carefully remove the clips -arrows-.

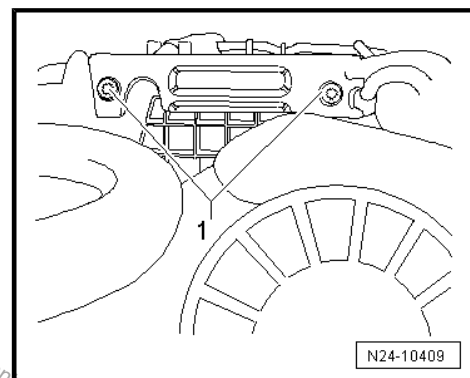




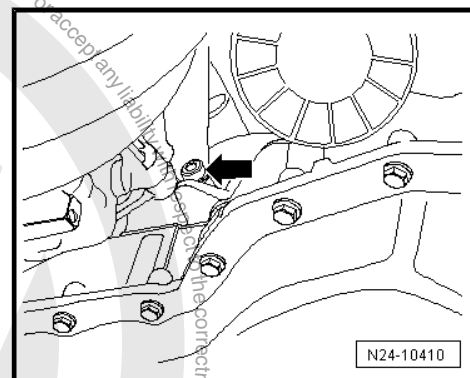
- Remove the oil dipstick -1- and push the retaining ring -4- downward.
- Remove the noise insulation. Refer to ⇒ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



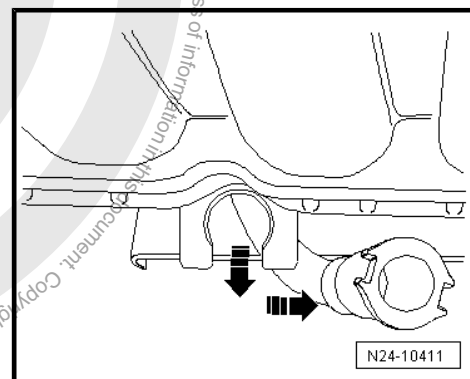
- Loosen the bolts or nuts -1- on the intake manifold lower section.



- Loosen the bolt -arrow- for the guide tube.



- Move the guide tube in direction of -arrows- to the side.





- If equipped, open the clip -arrow- on the Leak Detection Pump - V144- vacuum hose.

- Remove the intake manifold bolts -arrows- from the cylinder head using the Socket And Extended Bit - T10107A- .

The bolts remain in the intake manifold.

- Remove the intake manifold upward at an angle.

Make sure that no bolts fall out.

- Plug the intake duct in the cylinder head with clean cloths.

If manifold must be replaced:

- Remove the fuel rail with the valve. Refer to [⇒ "2.2 Fuel Injectors, Removing and Installing", page 179](#) .

- Remove the vacuum hose for the Leak Detection Pump - V144- .

- Remove the Manifold Absolute Pressure Sensor - G71- .

Installing

Install in reverse order of removal. Note the following:

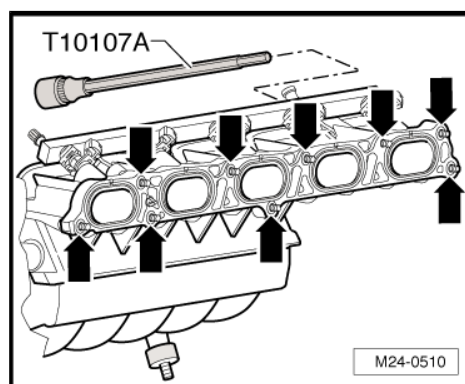
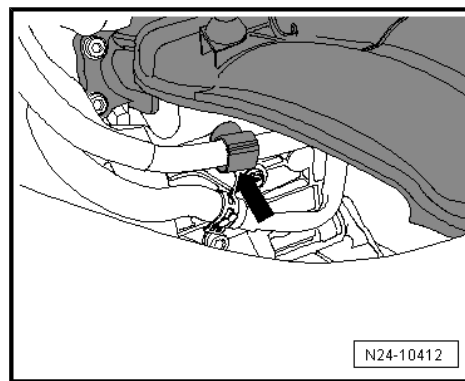
- ◆ Replace sealing rings between intake manifold and cylinder head.
- ◆ Tighten bolts for intake manifold starting inside working toward outside and in diagonal sequence.

- Connect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Disconnecting and Connecting .

- Bleed the fuel system. Refer to [⇒ "1.2 Fuel System, Filling/Bleeding", page 176](#) .

Tightening Specifications

- ◆ Refer to [⇒ "4.1 Overview - Intake Manifold", page 187](#)
- ◆ Refer to [⇒ "2.1 Overview - Fuel Rail with Fuel Injectors", page 179](#)





5 Engine Control Module

⇒ **"5.1 Engine Control Module J623 , Removing and Installing", page 193**

⇒ **"5.2 Engine Control Module J623 with Protective Housing, Removing and Installing", page 194**

5.1 Engine Control Module - J623- , Removing and Installing

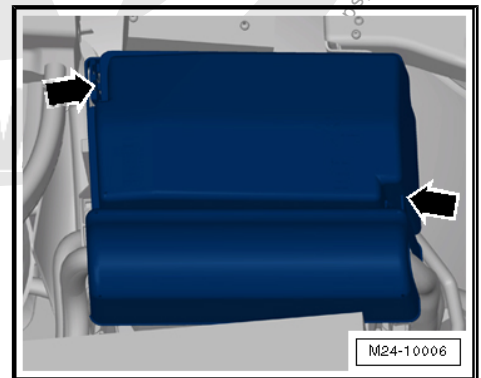


Note

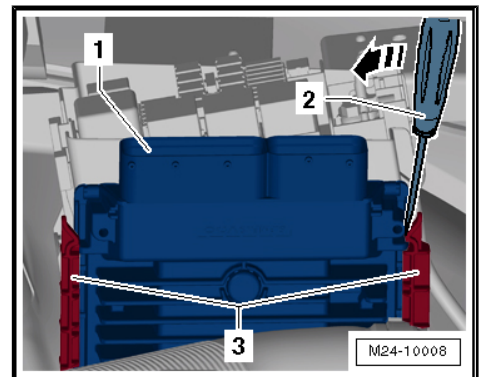
If it is necessary to replace the engine control module, connect the Vehicle Diagnostic Tester and perform "Replace control module".

Removing

- Turn off the ignition.
- Remove the E-box cover inside the engine compartment -arrows-.
- Unlock and disconnect the connector from the engine control module.
- Push the tabs on the side guides -3- carefully toward the outside with a screwdriver -2-.

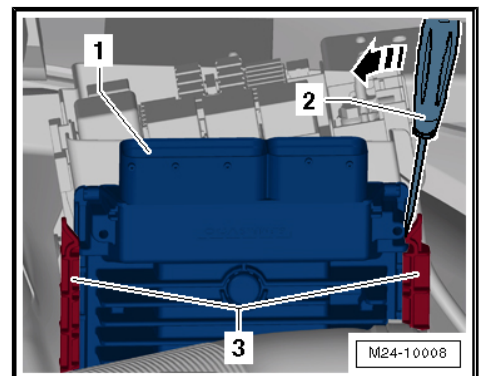


- Remove the engine control module -1- from the guides -3-.



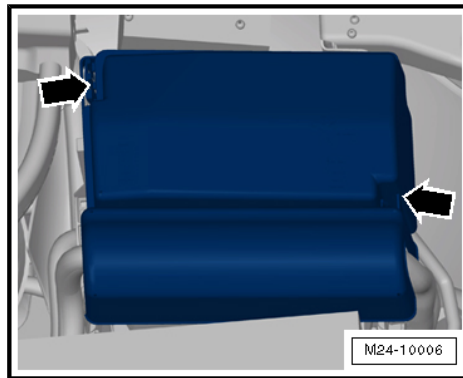
Installing

- Install the engine control module -1- into the guides -3- until it locks.
- Connect the connector to the engine control module.





- Install the E-box cover -arrows-.



5.2 Engine Control Module - J623- with Protective Housing, Removing and Installing

Special tools and workshop equipment required

- ♦ Cutting grinder, such as the Axial Grinder - VAS6682-

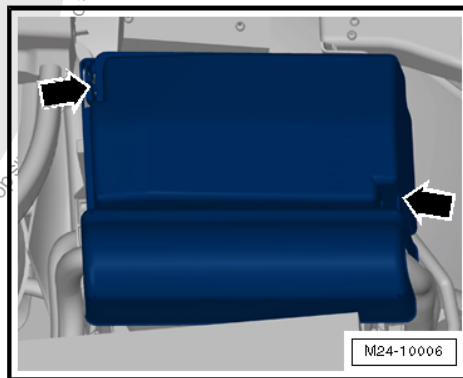


Note

- ♦ *If it is necessary to replace the engine control module, connect the Vehicle Diagnostic Tester and perform "Replace control module".*
- ♦ *Shear bolts attach the protective housing. It is not possible to remove the shear bolts without damaging them. Use Axial Grinder - VAS6682- or a cutting grinder to remove the shear bolts. Replace the protective housing if it gets damaged.*

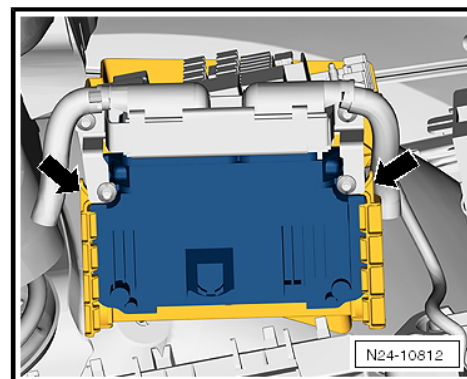
Removing

- Turn off the ignition.
- Remove the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .
- Remove the E-box cover inside the engine compartment -arrows-.

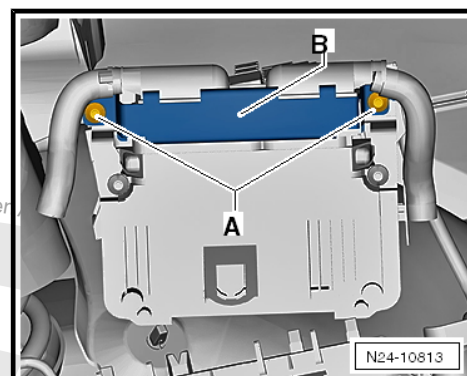




- Free up the wiring harness and pull engine control module upward out of its mount. Push the locking mechanisms -arrows- to the side.

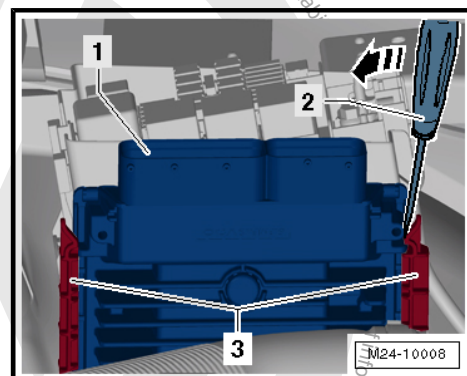


- Remove the bolts -A-. Push the wiring harness as far as possible to the side. Remove the locking mechanism -B-.
- Unlock the connector and pull it off the engine control module.

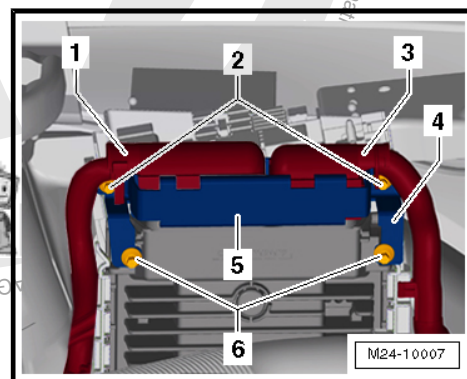


Installing

- Install the engine control module -1- into the guides -3- until it locks.

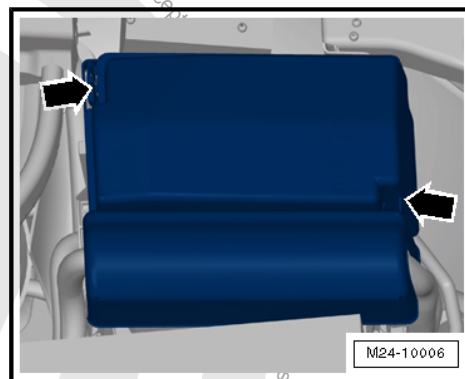


- If the control module was replaced, then attach the bracket -4- to the engine control module with shear bolts -6-.
- Tighten the shear bolts -6- just enough until the bolt head breaks off.
- Connect the connectors -1- and -3- to the engine control module.
- Install the locking mechanism -5- with shear bolts -2-.
- Tighten the shear bolts -2- until the bolt heads break off.





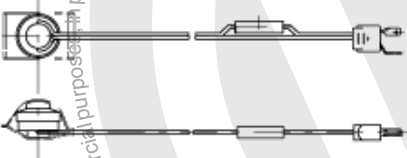

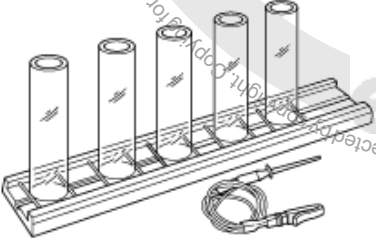

- Install the E-box cover, arrows-.
- Install the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Battery; Battery, Removing and Installing .





6 Special Tools

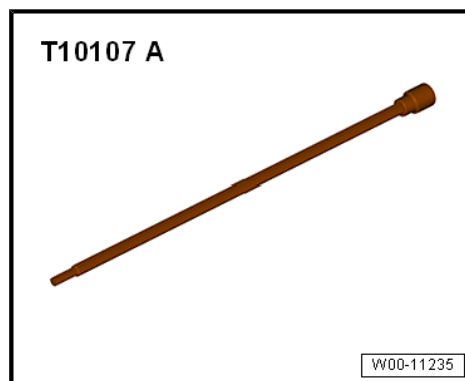
Special tools and workshop equipment required

<p>V.A.G 1348/3</p> 	<p>V.A.G 1348/3-2</p> 
<p>V.A.G 1602</p> 	<p>V.A.G 1594 C</p> 
	<p>W24-10005</p>

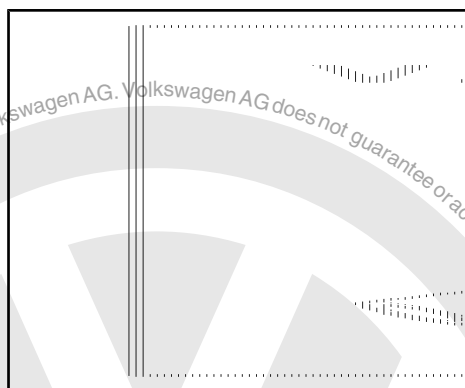
- ◆ Injection Rate Comparison Meter Kit - Remote Cable - VAG1348/3A-
- ◆ Injection Rate Comparison Meter Kit - Adapter - VAG1348/3-2-
- ◆ Injection Rate Tester - VAG1602-
- ◆ Connector Test Set - VAG1594D-
- ◆ Vehicle Diagnostic Tester - Test Adapter - 5 Pin - VAS5565-



- ◆ Socket and Extended Bit - T10107A-



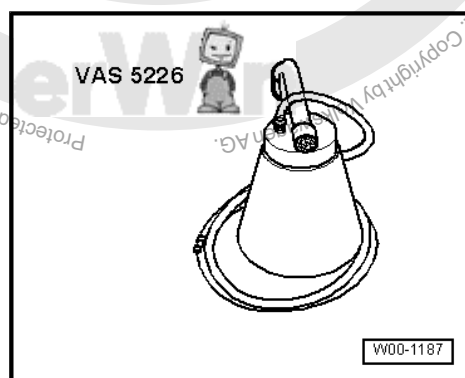
- ◆ Fuel Injection Gauge Kit - Fuel Bleeder 20 - VAG1318/20-



- ◆ Torque Wrench 1331 5-50Nm - VAG1331



- ◆ Suction Pump - VAS5226-



- ◆ Vehicle Diagnostic Tester



26 – Exhaust System, Emission Controls

1 Exhaust Pipes/Mufflers

⇒ [“1.1 Overview - Muffler”, page 199](#)

⇒ [“1.2 Muffler, Removing and Installing”, page 200](#)

⇒ [“1.3 Exhaust System, Installing without Tension”, page 201](#)

1.1 Overview - Muffler



Note

- ◆ After exhaust system repairs, make sure exhaust system is not under stress and that it has sufficient clearance from the bodywork. If necessary, loosen clamp(s) and align exhaust pipe so that sufficient clearance is maintained to the bodywork and support rings carry uniform loads.
- ◆ Gaskets and self-locking nuts must be replaced.

1 - From Front Exhaust Pipe

2 - Bolt

- ☐ 26 Nm
- ☐ Replace after removing
- ☐ For attaching the fuel tank

3 - Mount

4 - Bolt

- ☐ 23 Nm

5 - Center Muffler

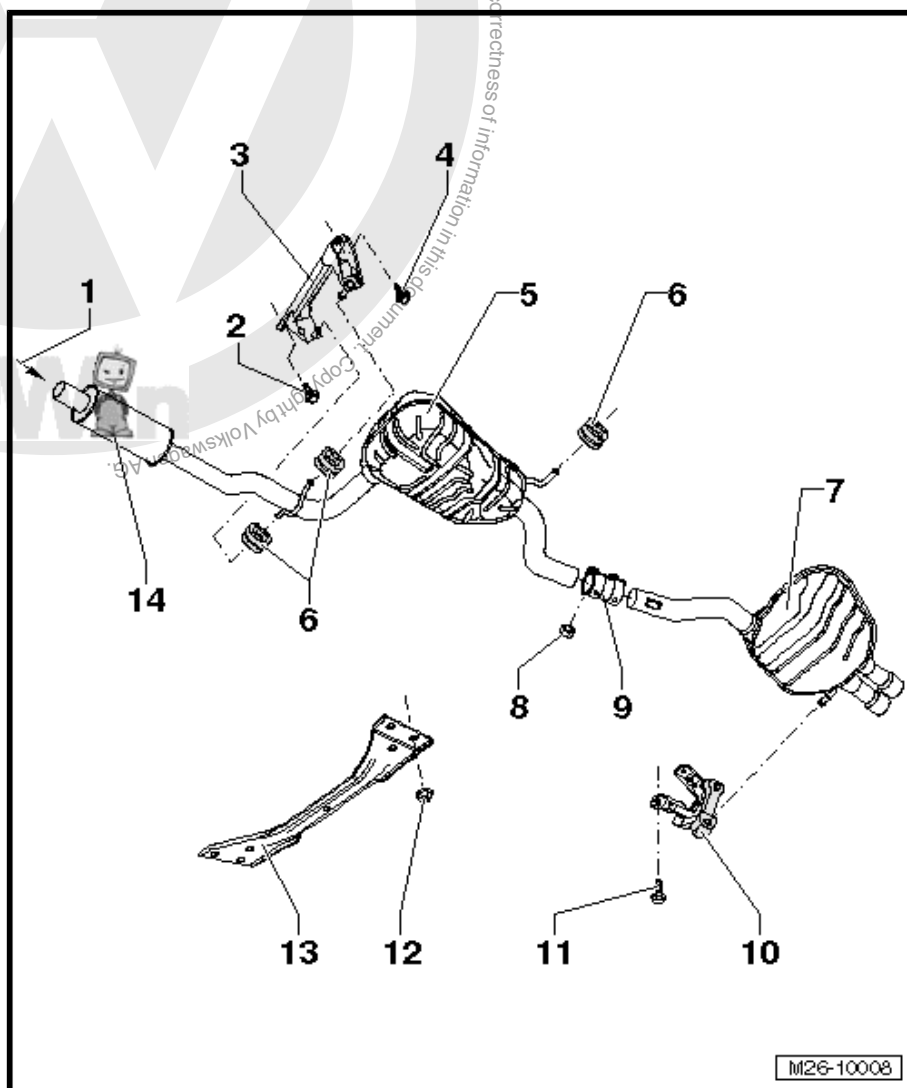
- ☐ Original equipment as one unit with rear muffler. For repairs, replace each separately
- ☐ Exhaust System, Installing without Tension. Refer to
 ⇒ [“1.3 Exhaust System, Installing without Tension”, page 201](#) .
- ☐ Exhaust System, Separating. Refer to
 ⇒ [“1.2 Muffler, Removing and Installing”, page 200](#) .

6 - Retaining Loop

- ☐ Replace if damaged

7 - Rear Muffler

- ☐ Original equipment as one unit with center muffler. For repairs, replace each separately
- ☐ Exhaust System, Installing without Tension. Refer to ⇒ [“1.3 Exhaust System, Installing without Tension”, page 201](#) .



M26-10008



- ☐ Exhaust System, Separating. Refer to ➔ [“1.2 Muffler, Removing and Installing”, page 200](#) .

8 - Nut

- ☐ 23 Nm

9 - Repair Clamp

- ☐ For individual replacement of center and rear mufflers
- ☐ Installed position. Refer to ➔ [“1.2 Muffler, Removing and Installing”, page 200](#)
- ☐ Tighten the bolted connections evenly

10 - Mount

- ☐ Replace if damaged

11 - Bolt

- ☐ 23 Nm

12 - Bolt

- ☐ 20 Nm

13 - Rear Tunnel Brace

14 - Front Muffler

1.2 Muffler, Removing and Installing



Note

- ◆ *After exhaust system repairs, make sure exhaust system is not under stress and that it has sufficient clearance from the bodywork. If necessary, loosen clamp(s) and align exhaust pipe so that sufficient clearance is maintained to the bodywork and support rings carry uniform loads.*
- ◆ *Gaskets and self-locking nuts must be replaced.*
- ◆ A separating point has been provided in the connecting pipe for individual replacement of the center or rear muffler.
- ◆ The separating point is marked an indentation around the circumference of the exhaust pipe.

Special tools and workshop equipment required

- ◆ Pneumatic Body Saw - VAS6780- or
- ◆ Chain Pipe Cutter - VAS6254-
- ◆ Protective eyewear

Disconnecting

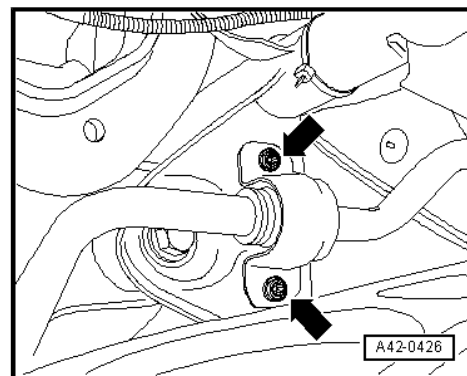


WARNING

To prevent injuries from metal shavings, wear protective goggles and protective clothing.



- Remove the bolts -arrows- from the left and right clamps on the stabilizer bar and move the stabilizer bar to the side.



- Cut the exhaust pipe at a right angle at the separating point -arrow 2- using, for example a Body Saw - VAG1523A- .

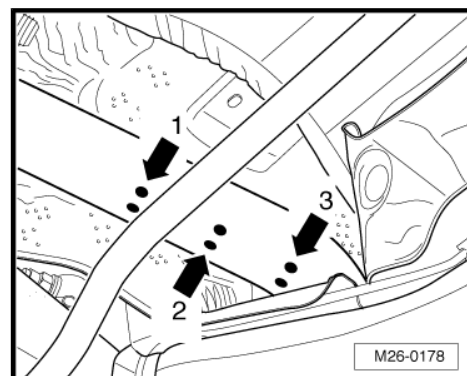
Connecting



Note

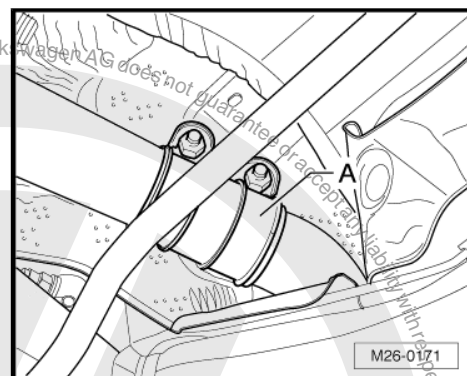
A second mechanic is required for installing the repair clamping sleeve.

- Secure the center muffler in the mounts. The front clamp remains loosely placed on the pipes.
- Align the rear muffler horizontally and hold it in this position.
- Position the repair clamping sleeve at the side markings -arrow 1- and -arrow 3-.



- Turn the repair clamping sleeve -A- as shown and tighten.

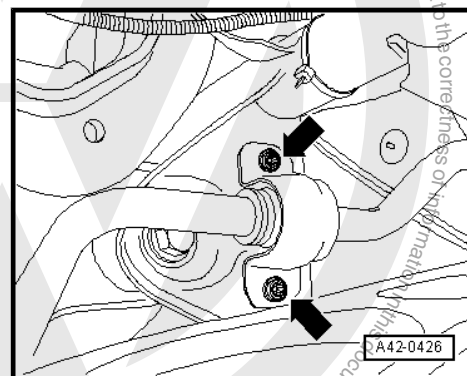
- Align the exhaust system free of tension. Refer to ⇒ ["1.3 Exhaust System, Installing without Tension", page 201](#) .



- Attach the stabilizer bar to the rear axle. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 42 ; Stabilizer Bar; Stabilizer Bar Assembly Overview .

Tightening Specifications

- ♦ Refer to ⇒ ["1.1 Overview - Muffler", page 199](#)

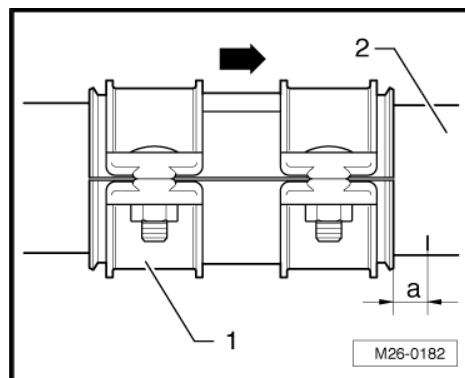


1.3 Exhaust System, Installing without Tension

Special tools and workshop equipment required

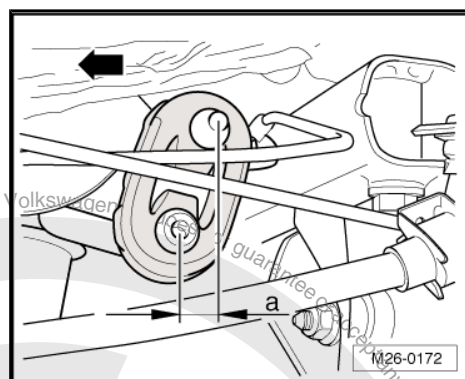


- ◆ Torque Wrench 1331 5-50Nm - V.A.G1331-
- Exhaust system must be aligned when cold.
- Loosen the threaded connections on the front clamp -1-.
- Position the clamp -1- so that dimension -a- for the marking on the pipe -2- equals 5 mm and then tighten the front bolt hand-tight. The -arrow- points in the direction of travel.
- Push the exhaust system as far forward until the dimension -a- on the outer retaining loop of the center muffler is 9 to 11 mm. The -arrow- points in the direction of travel.



- Tighten front clamp in this position evenly to 25 Nm.

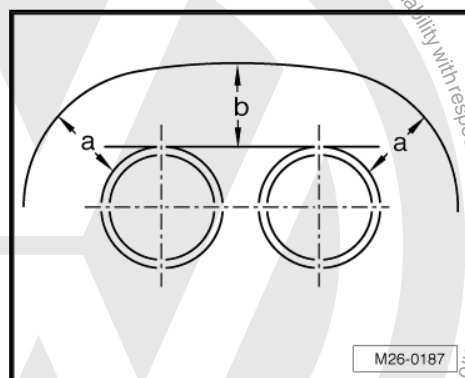
Aligning the Tail Pipe



- Align the rear muffler so distance -a- between the bumper opening and right and left tail pipes is equal.

Distance -b- from the bumper opening to the tail pipes must be parallel.

- Align the tail pipe if necessary loosen the rear muffler mount.





2 Emissions Control

⇒ [“2.1 Overview - Emissions Control”, page 203](#)

⇒ [“2.2 Catalytic Converter, Removing and Installing”, page 207](#)

2.1 Overview - Emissions Control

⇒ [“2.1.1 Exhaust Cleaning System Assembly Overview, Engine Code CBTA, CCCA”, page 203](#)

⇒ [“2.1.2 Exhaust Cleaning System Assembly Overview, Engine Code CBUA”, page 205](#)

2.1.1 Exhaust Cleaning System Assembly Overview, Engine Code CBTA, CCCA



Note

- ◆ *After exhaust system repairs, make sure exhaust system is not under stress and that it has sufficient clearance from the bodywork. If necessary, loosen clamp(s) and align exhaust pipe so that sufficient clearance is maintained to the bodywork and support rings carry uniform loads.*
- ◆ *Gaskets and self-locking nuts must be replaced.*



1 - Exhaust Manifold

- ☐ Coat the stud bolts with Hot Bolt Paste - G 052 118 A3- .

2 - Seal

- ☐ Replace
- ☐ Note installation position:

Gasket recess -arrow A- must be located at exhaust manifold recess -arrow B-.

3 - Nut

- ☐ 23 Nm
- ☐ Replace after removing

4 - Front Exhaust Pipe

- ☐ With catalytic converter
- ☐ Removing and Installing. Refer to [⇒ "2.2 Catalytic Converter, Removing and Installing", page 207](#) .

5 - Clamp

- ☐ Before tightening, ensure exhaust system is tension-free. Refer to [⇒ "1.3 Exhaust System, Installing without Tension", page 201](#) .

- ☐ Installed position. Refer to [⇒ Fig. "Installation Position of Clamp" page 205](#)

- ☐ Tighten the bolted connections evenly

6 - Nut

- ☐ 23 Nm

7 - Nut

- ☐ 20 Nm

8 - Front Tunnel Brace

9 - Oxygen Sensor after Three Way Catalytic Converter - G130- , 55 Nm

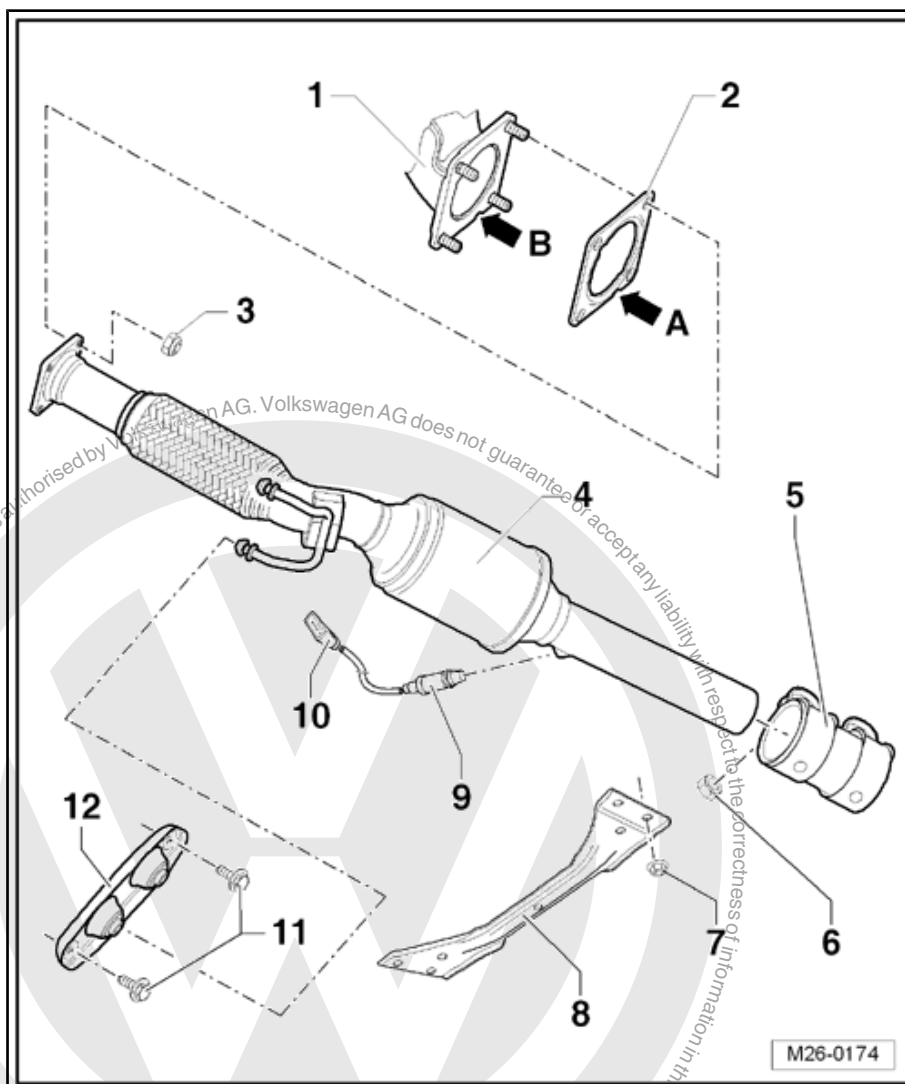
- ☐ Removing and installing with Ring Wrench 7-Piece Set - 3337-
- ☐ Coat the threads on the new heated oxygen sensors with assembly paste.
- ☐ For a reused heated oxygen sensor, only grease the threads with Hot Bolt Paste - G 052 112 A3- . Do not let the paste enter the slits on the sensor body.
- ☐ If sealing ring is leaking cut open and replace.

10 - Connector

- ☐ Brown, 4-pin
- ☐ Installed position. Refer to [⇒ Fig. "Oxygen Sensor Connector Installed Position" , page 205](#)

11 - Bolt

- ☐ 23 Nm





12 - Mount

- ❑ Replace if damaged

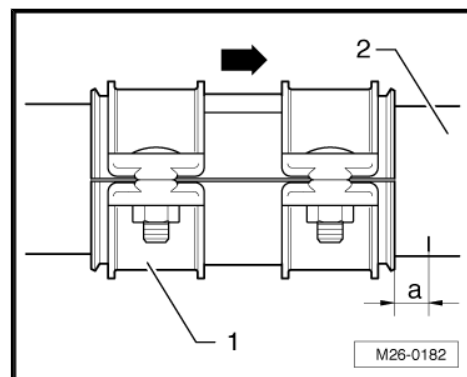
Installation Position of Clamp

The -arrow- points in the direction of travel.

- Line up the clamp -1- with the marking on the catalytic converter -2-.

-a- = 5 mm

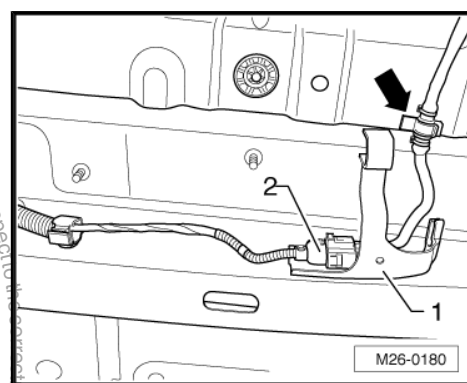
Mounting bolts must not project beyond the lower edge of the clamp.



Oxygen Sensor Connector Installed Position

The connector is located to the right, on the vehicle floor under the cover.

- 1 - Bracket
- 2 - Connector for Oxygen Sensor after Three Way Catalytic Converter - G130- , brown



2.1.2 Exhaust Cleaning System Assembly Overview, Engine Code CBUA



Note

- ◆ After exhaust system repairs, make sure exhaust system is not under stress and that it has sufficient clearance from the bodywork. If necessary, loosen clamp(s) and align exhaust pipe so that sufficient clearance is maintained to the bodywork and support rings carry uniform loads.
- ◆ Gaskets and self-locking nuts must be replaced.

1 - Exhaust Manifold

- ☐ Coat the stud bolts with Hot Bolt Paste - G 052 118 A3- .

2 - Seal

- ☐ Replace
- ☐ Note installation position:

Gasket recess -arrow A- must be located at exhaust manifold recess -arrow B-.

3 - Connector

- ☐ Black, 4-pin

4 - Oxygen Sensor in Bank 1 Center Three Way Catalytic Converter - G465- , 55 Nm

- ☐ Removing and installing with Ring Wrench 7-Piece Set - 3337-
- ☐ Coat the threads on the new heated oxygen sensors with assembly paste.
- ☐ For a reused heated oxygen sensor, only grease the threads with Hot Bolt Paste - G 052 112 A3- . Do not let the paste enter the slits on the sensor body.
- ☐ If sealing ring is leaking cut open and replace.

5 - Spring Nut

- ☐ Insert from front

6 - Clamp

- ☐ Before tightening, ensure exhaust system is tension-free. Refer to [⇒ "1.3 Exhaust System, Installing without Tension", page 201](#) .
- ☐ Installed position. Refer to [⇒ Fig. ""Installation Position of Clamp"" , page 207](#)
- ☐ Tighten the bolted connections evenly

7 - Nut

- ☐ 23 Nm

8 - Nut

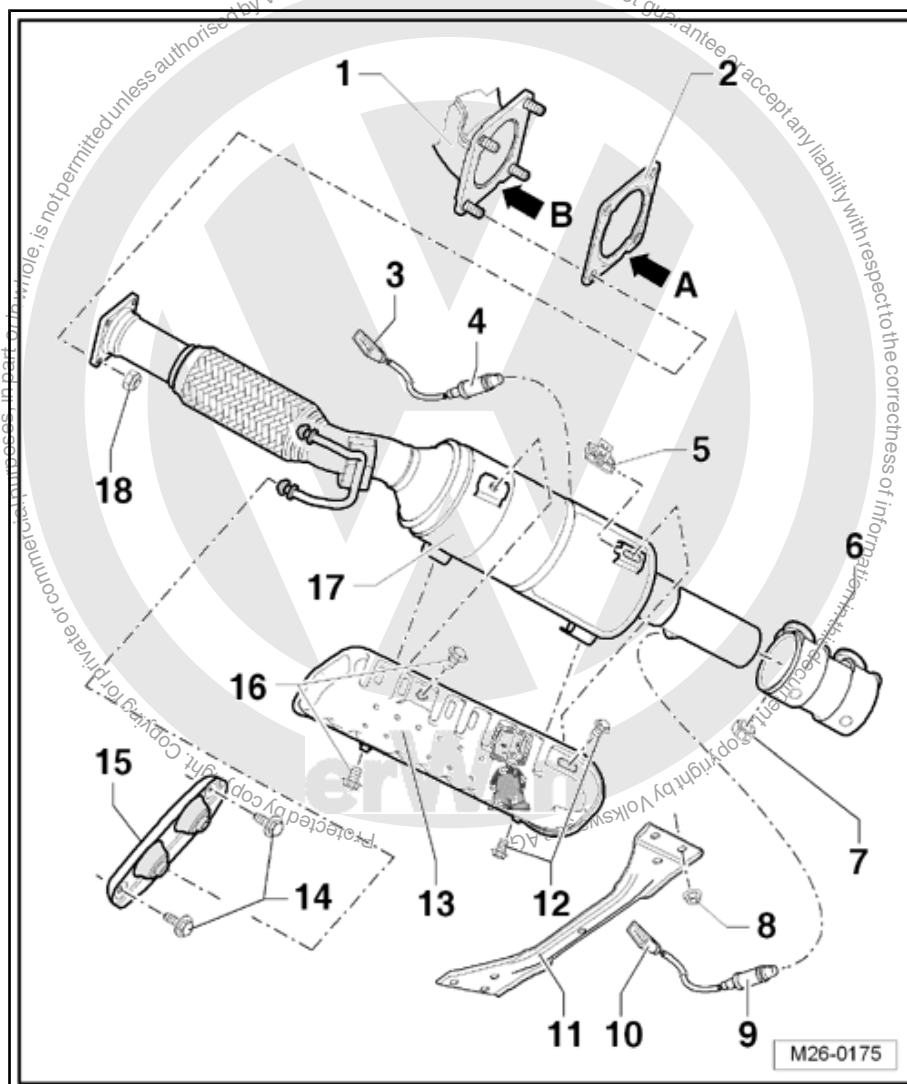
- ☐ 20 Nm

9 - Oxygen Sensor after Three Way Catalytic Converter - G130- , 55 Nm

- ☐ Removing and installing with Ring Wrench 7-Piece Set - 3337-
- ☐ Coat the threads on the new heated oxygen sensors with assembly paste.
- ☐ For a reused heated oxygen sensor, only grease the threads with Hot Bolt Paste - G 052 112 A3- . Do not let the paste enter the slits on the sensor body.
- ☐ If sealing ring is leaking cut open and replace.

10 - Connector

- ☐ Brown, 4-pin
- ☐ Installed position. Refer to [⇒ Fig. ""Oxygen Sensor Connector Installed Position"" , page 207](#)





11 - Front Tunnel Brace

12 - Bolt

- ☐ 5 Nm

13 - Heat Shield

- ☐ For catalytic converter

14 - Bolt

- ☐ 23 Nm

15 - Mount

- ☐ Replace if damaged

16 - Bolt

- ☐ 10 Nm

17 - Front Exhaust Pipe

- ☐ With catalytic converter
- ☐ Removing and Installing. Refer to ➔ ["2.2 Catalytic Converter, Removing and Installing", page 207](#) .

18 - Bolt

- ☐ 23 Nm
- ☐ Replace after removing

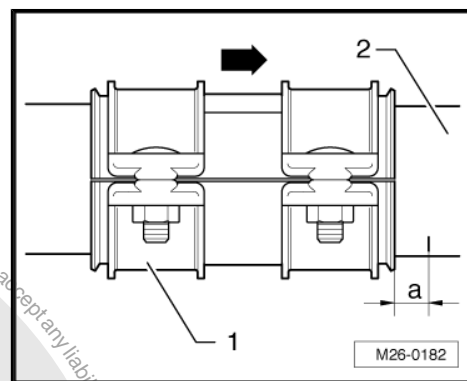
Installation Position of Clamp

The -arrow- points in the direction of travel.

- Line up the clamp -1- with the marking on the catalytic converter -2-.

-a- = 5 mm

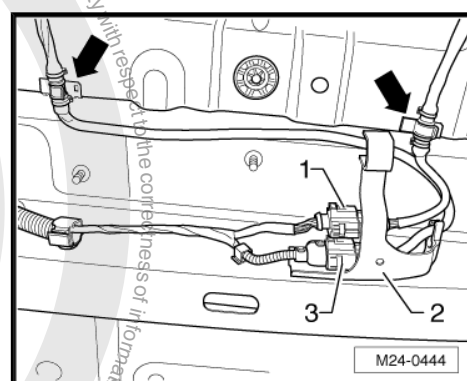
The bolts must be on right side. They must not project beyond the lower edge of the clamp.



Oxygen Sensor Connector Installed Position

The connector is located to the right, on the vehicle floor under the cover.

- 1 - Connector for Oxygen Sensor after Three Way Catalytic Converter - G130- , brown
- 2 - Bracket
- 3 - Connector for Oxygen Sensor in Bank 1 Center Three Way Catalytic Converter - G465- , black



2.2 Catalytic Converter, Removing and Installing

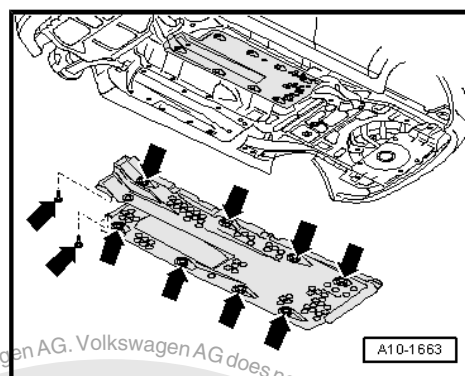
Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - V.A.G1331-
- ◆ Hot Bolt Paste - G 052 118 A3-



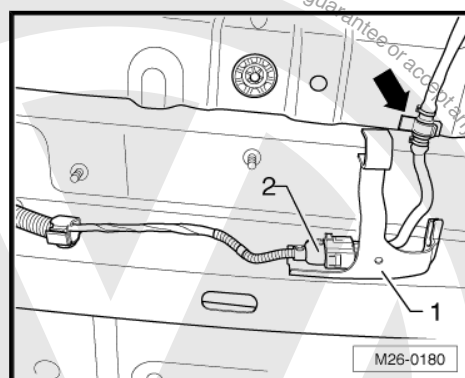
Removing

- If equipped remove the right underbody panel -arrows-.



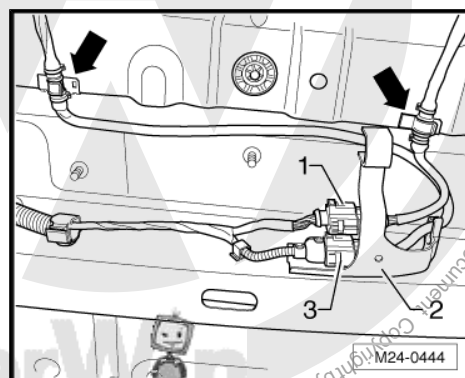
Engine Code CBTA, CCCA

- Unclip the wire -arrow-, pull off bracket -1- and disconnect the connector -2- for Oxygen Sensor after Three Way Catalytic Converter - G130- .



Engine Code CBUA

- Unclip lines -arrows-, pull off bracket -2- and separate connectors -1- for Oxygen Sensor after Three Way Catalytic Converter - G130- and -3- for Oxygen Sensor in Bank 1 Center Three Way Catalytic Converter - G465- .



Continuation for All

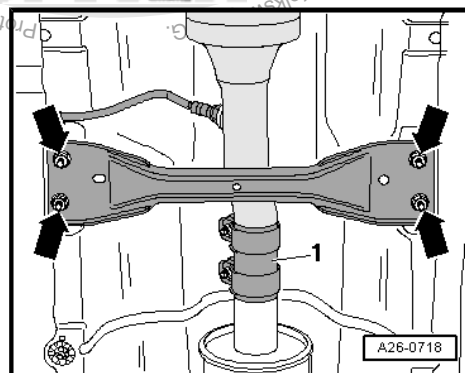
- Loosen the screws on the clamp -1-. Do not remove the front underbody tunnel bridge.



Caution

Danger of causing damage to the decoupling element.

- ◆ ***Do not bend the decoupling element more than 10°.***
- ◆ ***Do not stretch the decoupling element.***
- ◆ ***Do not damage the wire mesh on the decoupling element.***



- Remove the nuts -2- on the front exhaust pipe/exhaust manifold and then the bolts -3-.



- Remove the front exhaust pipe -1- and catalytic converter from the exhaust manifold, push it them to the side and guide them under the front crossmember.

Installing

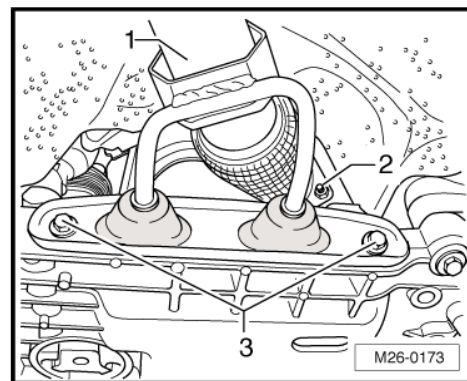
Install in reverse order of removal. Note the following:

- ◆ Replace the seals and self-locking nuts.
- ◆ Install the exhaust system free of tension. Refer to [⇒ "1.3 Exhaust System, Installing without Tension", page 201](#) .

7) Coat stud bolts on exhaust manifold with Hot Bolt Paste - G 052 118 A3- .

Tightening Specifications

- ◆ Refer to [⇒ "2.1.1 Exhaust Cleaning System Assembly Overview, Engine Code CBTA, CCCA", page 203](#)
- ◆ Refer to [⇒ "2.1.2 Exhaust Cleaning System Assembly Overview, Engine Code CBUA", page 205](#)



⇒ **“3.4 Secondary Air Injection Solenoid Valve, Checking”,**
page 213

10 Nm





11 - Intake Hose

- For secondary air injection pump

12 - Secondary Air Injection Pump Motor - V101-

- Removing and Installing. Refer to
⇒ [“3.2 Secondary Air Injection Pump Motor V101 , Removing and Installing”, page 211](#) .

13 - Rubber Bushing

14 - Bolt

- 25 Nm

15 - Nut

- 10 Nm

16 - Intake Manifold Support

- Mount for the Secondary Air Injection Pump Motor - V101-
- Not installed on vehicles without a secondary air system -item 12- ⇒ [Item 12 \(page 187\)](#) .

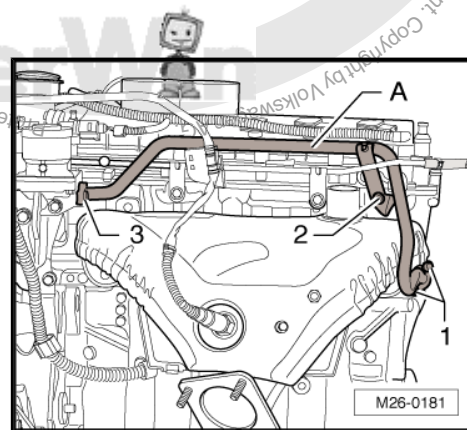
17 - Cylinder Head

18 - Intake Hose

Connecting Pipe - Tightening Sequence

- Replace all seals and the connecting pipe -A-.
- Tighten all the bolts only hand-tight.
- First tighten the bolt -1-, then the bolt -2- and finally the bolts -3-.

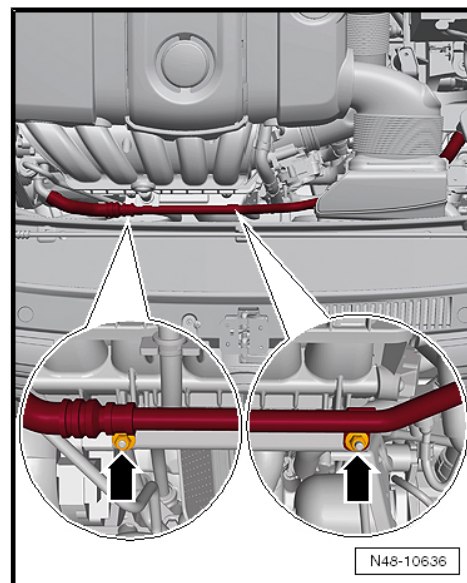
Step	Bolts	Tightening Specifications
1.	-1-	Tighten to 10 Nm
2.	-2-	Tighten to 10 Nm
3.	-3-	Tighten to 10 Nm



3.2 Secondary Air Injection Pump Motor - V101- , Removing and Installing

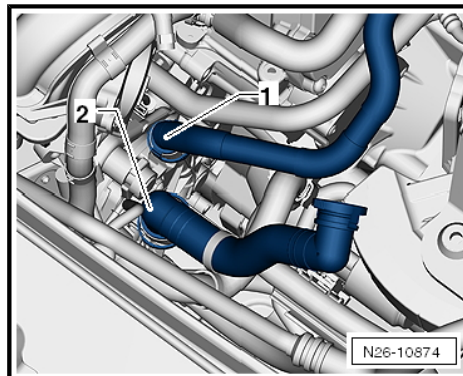
Removing

- Remove the nuts from the return line -arrows-.
- Remove the throttle valve control module. Refer to
⇒ [“4.2 Throttle Valve Control Module J338 , Removing and Installing”, page 188](#) .

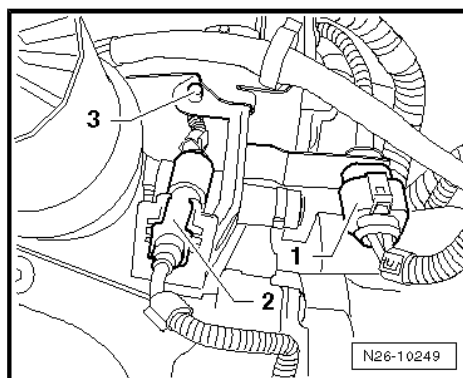




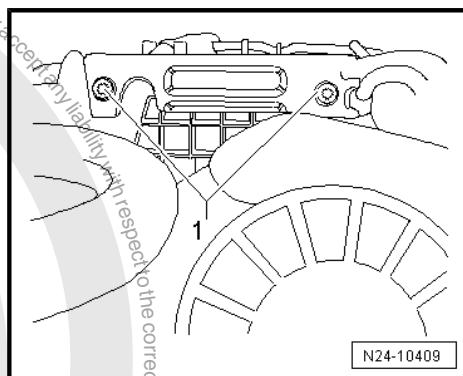
- Remove the pressure hose -1- and the intake hose -2-. To do so, compress securing ring.
- Remove the noise insulation. Refer to ➔ Body Exterior; Rep. Gr. 66 ; Noise Insulation; Overview - Noise Insulation .



- Disconnect connectors -1- and -2-.
- Remove the clip -3- from the cable guide.
- Press out cable clip at top front mounting bolt.



- Remove the secondary air pump bracket bolts -1- from the intake manifold.
- Remove the lower bolt -arrow- from the secondary air pump bracket.



- Move the secondary air pump bracket slightly to the side. Remove the nuts and the Secondary Air Injection Pump Motor - V101- .

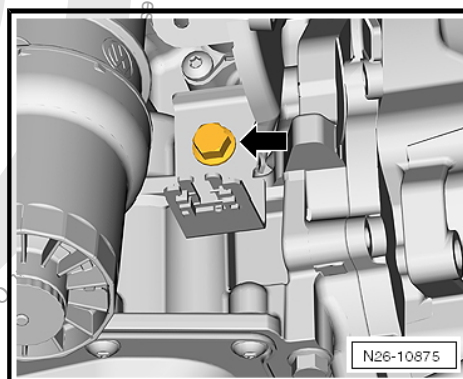
Installing

Install in reverse order of removal. Note the following:

- ◆ Make sure that pressure pipe and intake hose lock securely to Secondary Air Injection Pump Motor - V101- .

Tightening Specifications

- ◆ Refer to
➔ [“3.1 Overview - Secondary Air Injection System”](#),
[page 210](#)

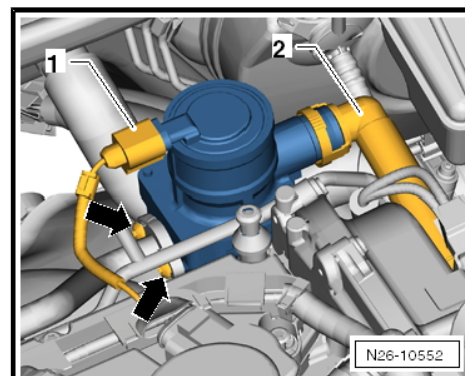




3.3 Secondary Air Injection Solenoid Valve - N112- , Removal and Installation

Removing

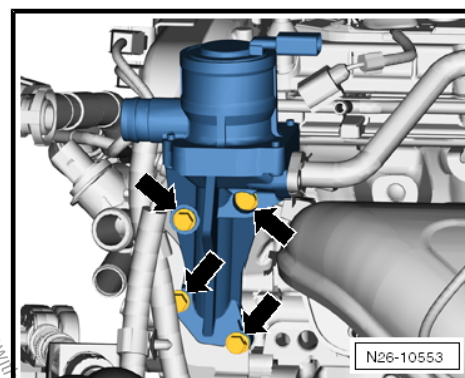
- Disconnect the connector -1- and remove the connecting pipe -2-.
- Remove the bolts -arrows- from the Secondary Air Injection (AIR) pipe.



- Remove the bolts from the AIR solenoid valve and remove the valve.

Installing

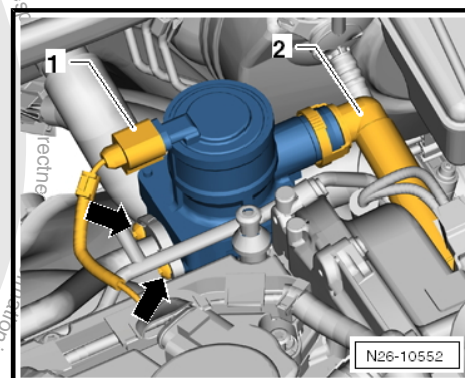
- Replace the gaskets.
- Only tighten the bolts by hand.
- Tighten the AIR pipe bolts -arrows- to the AIR solenoid valve.



- Connect the connector -1- and connecting pipe -2-. Make sure the connecting pipe is seated securely.

Tightening Specifications

Component	Nm
AIR solenoid valve	10
AIR pipe	10



3.4 Secondary Air Injection Solenoid Valve, Checking

Special tools and workshop equipment required

- ◆ Connector Test Set - VAG1594D-
- ◆ Assisting hose, e.g. coolant hose

Test Sequence



Note

Do not use compressed air during following check!



- Remove the air filter housing (engine cover). Refer to
⇒ [“3.2 Air Filter Housing, Removing and Installing”,
page 186](#) .
- Disconnect the pressure hose -2- from the Secondary Air Injection Solenoid Valve - N112- -3-. To do so, compress securing ring.
- Remove the connector -4-.
- Slide the adapter hose -1-, for example coolant hose, into the Secondary Air Injection Solenoid Valve - N112- .
- Blow using force in the adapter hose -arrow-.

The valve must be closed.

If air can be blown through the valve with a properly sealed adapter hose:

- Replace the Secondary Air Injection Solenoid Valve - N112- .

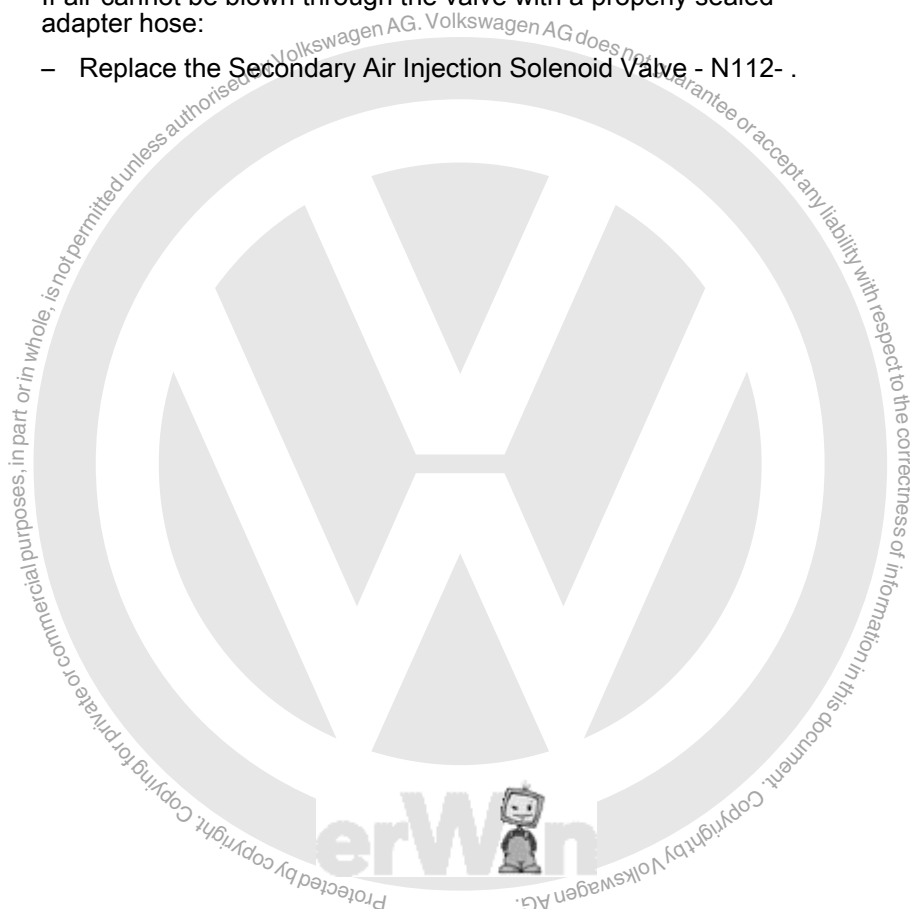
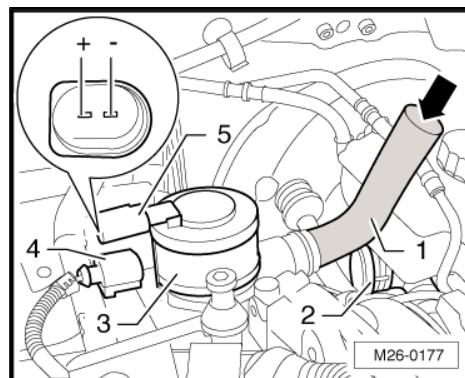
If the valve is closed:

- Connect terminals on connector connection -5- with adapter cables from Connector Test Set - VAG1594C- to battery positive (+) and negative (-).
- Blow using force in the adapter hose -arrow-.

The valve must be opened.

If air cannot be blown through the valve with a properly sealed adapter hose:

- Replace the Secondary Air Injection Solenoid Valve - N112- .





4 Exhaust Manifold

⇒ "4.1 Overview - Exhaust Manifold", page 215

4.1 Overview - Exhaust Manifold

1 - Nut

- ☐ 23 Nm
- ☐ Replace after removing

2 - Exhaust Manifold

- ☐ Coat stud bolts on cylinder head with Hot Bolt Paste - G 052 118 A3- .
- ☐ Remove upward

3 - Clip

4 - Bolt

- ☐ 10 Nm

5 - Heat Shield

6 - Heated Oxygen Sensor - G39- , 55 Nm

- ☐ Removing and installing with Ring Wrench 7-Piece Set - 3337-
- ☐ Coat the threads on the new heated oxygen sensors with assembly paste.
- ☐ For a reused heated oxygen sensor, only grease the threads with Hot Bolt Paste - G 052 112 A3-. Do not let the paste enter the slits on the sensor body.
- ☐ If sealing ring is leaking cut open and replace.
- ☐ Connector color: black

7 - Bolt

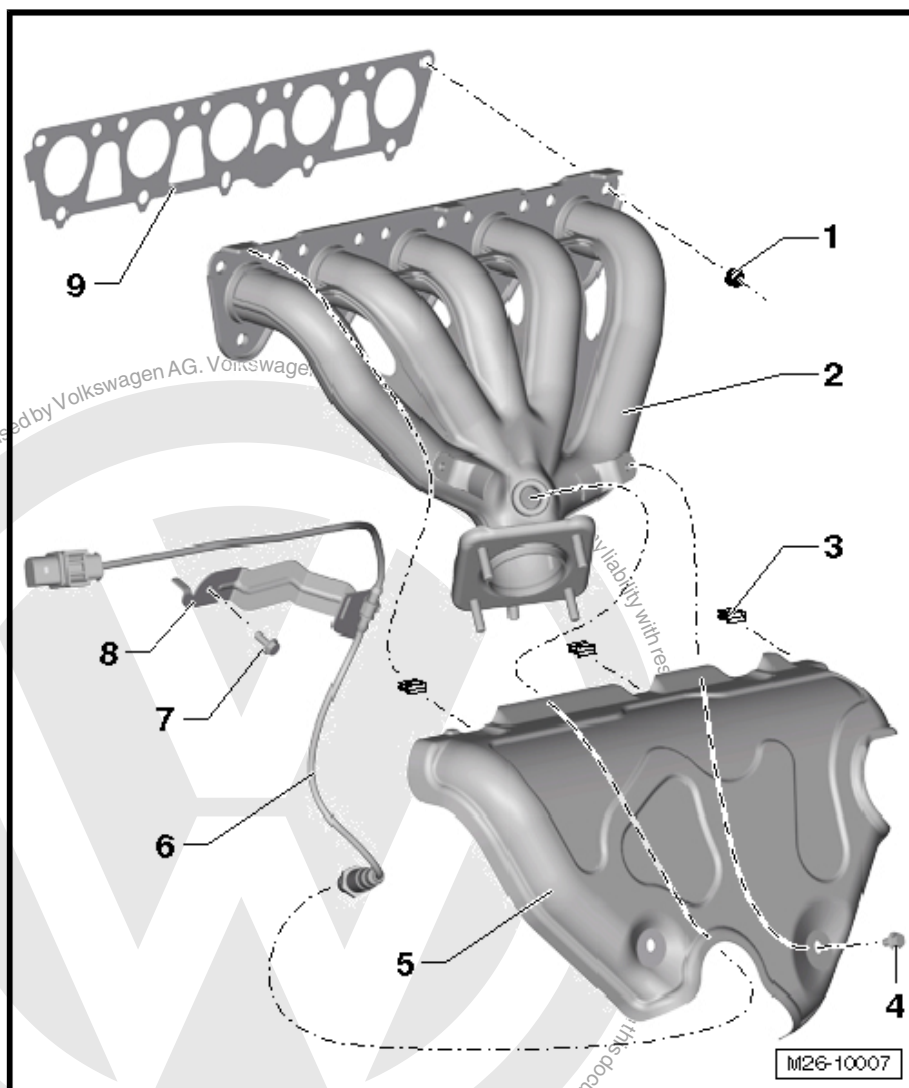
- ☐ 10 Nm

8 - Bracket

- ☐ For Heated Oxygen Sensor - G39-

9 - Seal

- ☐ Replace after removing





5 Special Tools

Special tools and workshop equipment required

- ◆ Torque Wrench 1331 5-50Nm - V.A.G1331-

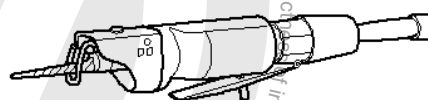
V.A.G 1331



W00-11166

- ◆ Pneumatic Body Saw - VAS6780- or

V.A.G 1523 B



W00-10931

- ◆ Connector Test Set - VAG1594D-

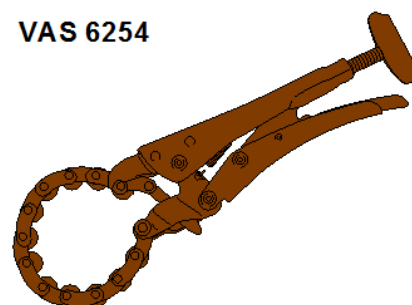
V.A.G 1594 C



W00-11191

- ◆ Chain Pipe Cutter - VAS6254-

VAS 6254



W00-11552

- ◆ Protective eyewear



28 – Ignition/Glow Plug System

1 Ignition System

⇒ [“1.1 Overview - Ignition System”, page 217](#)

⇒ [“1.2 Ignition Coils with Power Output Stages, Removing and Installing”, page 219](#)

⇒ [“1.3 Knock Sensor 1 G61 , Removing and Installing”, page 220](#)

⇒ [“1.4 Test Data and Spark Plugs”, page 221](#)

1.1 Overview - Ignition System

- ◆ For proper function of the electrical components, a voltage of at least 11.5 V is required.
- ◆ It is possible that the control module will recognize a malfunction and store a DTC during some tests. After completing all checks and repairs, check the DTC memory and erase the memory, if necessary. Refer to Vehicle Diagnostic Tester .
- ◆ If the engine only starts briefly and then turns off again after troubleshooting, repairs or checking the components, it may be that the immobilizer is blocking the engine control module. The engine control module may have to be adapted then. See Vehicle Diagnostic Tester “Guided Fault Finding” function



1 - Knock Sensor 2 - G66- Connector

- ☐ Gray
- ☐ Contacts gold plated
- ☐ Installed position. Refer to
⇒ [Fig. "Installation Position of Harness Connectors for Knock Sensors", page 219](#)

2 - Knock Sensor 1 - G61- Connector

- ☐ Green
- ☐ Contacts gold plated
- ☐ Installed position. Refer to
⇒ [Fig. "Installation Position of Harness Connectors for Knock Sensors", page 219](#)

3 - Knock Sensor 2 - G66-

- ☐ Pay attention to the installed position: the cable connect faces outward 45° to the right

4 - Knock Sensor 1 - G61-

- ☐ Pay attention to the installed position: the cable connection faces downward

5 - Bolt

- ☐ Tightening specifications affect function of Knock Sensor (KS)
- ☐ -Item 4- ⇒ [Item 4 \(page 220\)](#)

6 - Ignition Coils with Power Output Stage - N70, N127, N291, N292, N323-

- ☐ Removing and Installing. Refer to
⇒ ["1.2 Ignition Coils with Power Output Stages, Removing and Installing", page 219](#) .

7 - Spark Plug

- ☐ 25 Nm
- ☐ Type and Electrode Gap. Refer to ⇒ ["1.4 Test Data and Spark Plugs", page 221](#) .
- ☐ Remove and install with Spark Plug Removal Tool - 3122B- . Refer to
⇒ ["1.4 Test Data and Spark Plugs", page 221](#) .

8 - Bolt

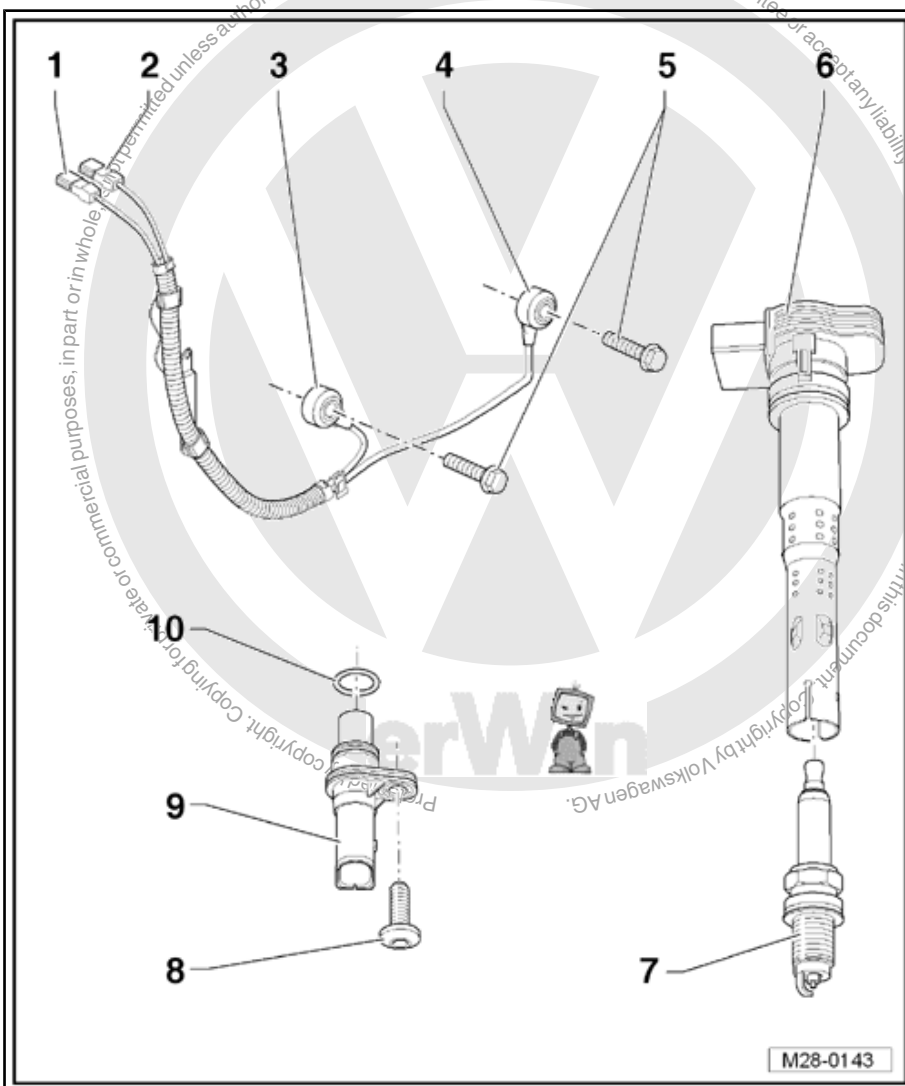
- ☐ 10 Nm

9 - Camshaft Position Sensor - G40-

- ☐ Contacts gold plated

10 - O-Ring

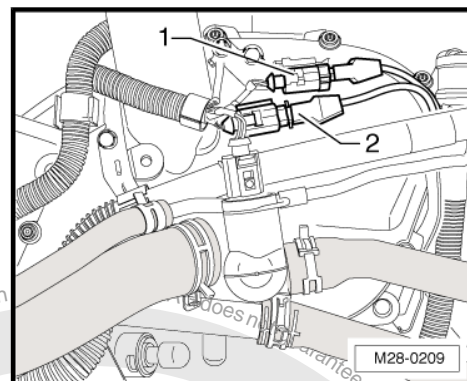
- ☐ No replacement part





Installation Position of Harness Connectors for Knock Sensors

- 1 - Green for Knock Sensor 1 - G61-
- 2 - Gray for Knock Sensor 2 - G66-



1.2 Ignition Coils with Power Output Stages, Removing and Installing

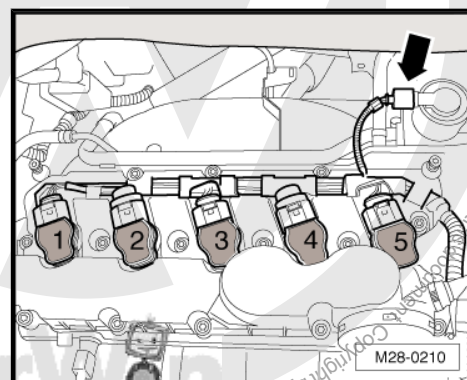
Special tools and workshop equipment required

- ◆ Puller - Ignition Coil - T40039-

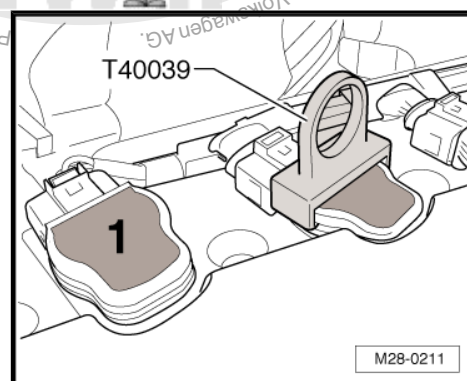
Removing

- Remove the air filter housing (engine cover). Refer to ["3.2 Air Filter Housing, Removing and Installing", page 186](#).
- Disconnect the connector from the Secondary Air Injection Solenoid Valve - N112- -arrow-, if equipped.

In order to prevent damage to the cable guide, remove the ignition coils with power output stage as follows:



- Using the Puller - Ignition Coil - T40039- , pull all ignition coils only approximately 10 mm out of spark plug shaft, starting with ignition coil -1-.
- Then pull all ignition coils another 10 mm in the same sequence.
- Disconnect all connectors and pull them out just a little.

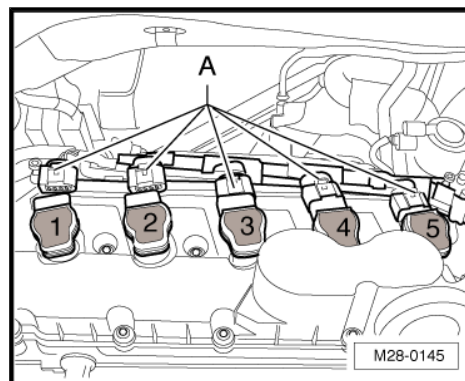




- Disconnect the connector -A- starting on the ignition coil -1-. Pull the ignition coils out of the spark plug shaft.

Installing

- Install all the ignition coils loosely into the spark plug shaft.
- Align the ignition coils in the openings in the cylinder head cover and then connect all the connectors in reverse order.
- Press the ignition coils evenly onto the spark plugs by hand.



1.3 Knock Sensor 1 - G61- Removing and Installing



Note

Two sensors are installed Knock Sensor 1 - G61- and Knock Sensor 2 - G66-.

1 - Cylinder Block

2 - Sealing Plug

- ☐ With rolled up seal
- ☐ Bore in cylinder block for securing crankshaft with Crankshaft Locking Pin -T40069- .
- ☐ Refer to [1.3 Knock Sensor 1 G61, Removing and Installing](#), page 220

3 - Knock Sensor 1 - G61-

- ☐ Pay attention to the installed position: the cable connection faces downward

4 - Bolts

- ☐ 20 Nm
- ☐ The tightening specifications affect function of the knock sensor

5 - Bolt

- ☐ 10 Nm

6 - Cover Plate

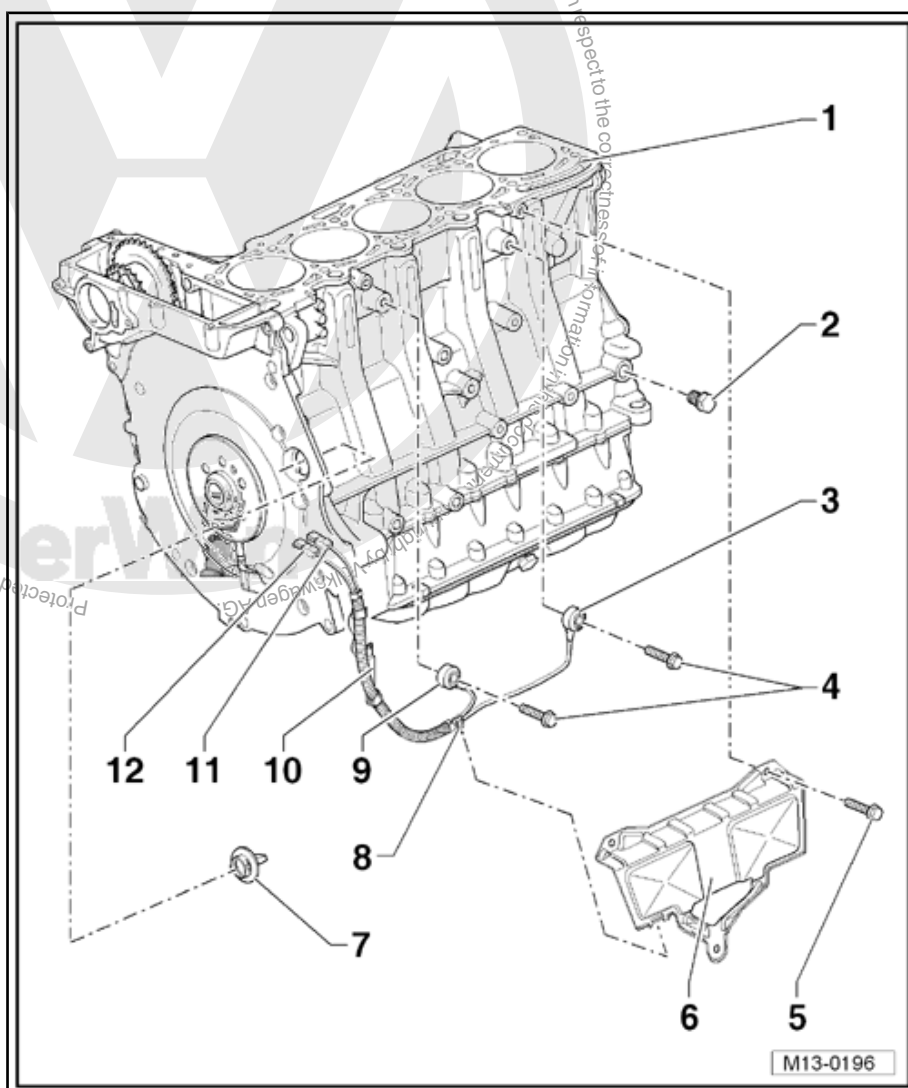
7 - Quick Release

8 - Cable Clamp

- ☐ Clamped on cover plate

9 - Knock Sensor 2 - G66-

- ☐ Pay attention to the installed position: the cable connect faces outward 45° to the right





10 - Wiring Bracket

- ☐ Bolted to secondary air injection solenoid valve

11 - Connector

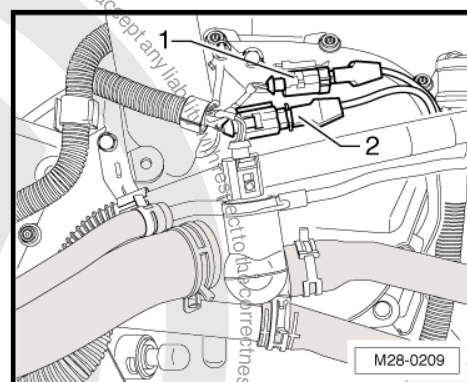
- ☐ Green for Knock Sensor 1 - G61-
- ☐ Installed position. Refer to
 ⇒ [Fig. "Installation Position of Harness Connectors for Knock Sensors"](#) , page 221
- ☐ Contacts gold plated

12 - Connector

- ☐ Gray for Knock Sensor 2 - G66-
- ☐ Installed position. Refer to
 ⇒ [Fig. "Installation Position of Harness Connectors for Knock Sensors"](#) , page 221
- ☐ Contacts gold plated

Installation Position of Harness Connectors for Knock Sensors

- 1 - Green for Knock Sensor 1 - G61-
- 2 - Gray for Knock Sensor 2 - G66-



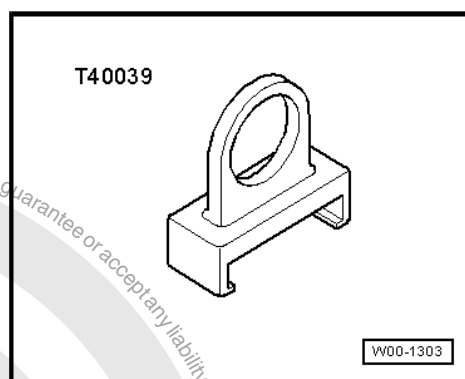
1.4 Test Data and Spark Plugs

Engine Codes	CBTA, CBUA, CCCA
Ignition sequence	1-2-4-5-3
Spark plugs	Refer to the Parts Catalog.
Electrode gap	1.0 to 1.1 mm
Tightening Specification	Refer to -Item 7- ⇒ Item 7 (page 218)
Change intervals	Refer to the ⇒ Maintenance ; Booklet ; Maintenance Tables .



2 Special Tools

Puller - Ignition Coil - T40039-





3 Revision History

DRUCK NUMBER: K0059075021

Fac- tory Edi- tion	Edit Edi- tion	Job Type	Fee dba ck	Notes	Quality Checke d By
01.2 015	04/0 6/20 18	Lo- cal Feed back	133 197 0	changed make sure the crankshaft can be turned to make sure the crankshaft cannot be turned in the Valve Timing, Adjusting procedure.	Eric P.
01.2 015	02/2 4/20 15	Lo- cal Feed back	108 082 0	Added N112 R&I from 5K1 per factory.	Eric P.
01.2 015	02/2 0/20 15	Fac- tory Up- date	N/A	No changes. Factory up- date change was only for oil capacity.	Eric P.
	01/1 3/20 15	Lo- cal Fac- tory Up- date	N/A	Did a complete Edit.	Eric P.
	01/1 2/20 15	Fac- tory New	106 685 7, 106 750 1, 106 751 1, and 106 684 8	Released with minimum edits, to fix the missing book.	Eric P.

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.
- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.
- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.
- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.
- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.
- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.
- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.
- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).
- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

